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BUREAU OF HYGIENE AND TROPICAL DISEASES

TROPICAL DISEASES BULLETIN

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SUMMARY OF RECENT ABSTRACTS *

II. YELLOW FEVER †

Epidemiology : Animal hosts

ALDIGHIERI (p. 1237) gives a long account of yellow fever in Central America. The disease had apparently disappeared from urban communities by about 1925, probably as a result of the campaign against *Aëdes aegypti*, but cases appeared in 1948 and there was evidence of an outbreak in howler monkeys in jungle areas. This outbreak was travelling at the rate of about 13 miles a month, taking 2 months to pass any one spot. CALVO and GALINDO (p. 789) also give an account of this striking outbreak of human yellow fever which started in 1948 in Panamá and which was of jungle type, presumably contracted from mosquitoes (*Haemagogus spegazzinii falco* and *Aëdes leucocelaenus*), themselves infected by biting infected monkeys (*Alouatta*). No doubt this was part of the outbreak later reported from Costa Rica. Examination of monkeys found dying or dead during this wave of jungle yellow fever in Costa Rica disclosed typical liver lesions in a considerable number. VARGAS-MENDEZ and ELTON (p. 168) state that resistance of acidophilic material (Councilman bodies) to autolysis in putrefying carcasses is rarely seen except in yellow fever, and is quite distinctive, and some of the diagnoses were based on this. The work confirms the previously presumptive evidence that this monkey outbreak was, in fact, yellow fever.

Although urban yellow fever has not been reported in Ecuador since 1919, jungle yellow fever in man appeared as an outbreak in 1949. GARCÍA SOLÓRZANO (p. 482) shows that DDT campaigns against *Aëdes aegypti* have been very successful in Guayaquil and other towns, but jungle yellow fever remains in one province and in some mountainous regions. No epidemic of yellow fever has been reported in French Guiana since 1902, but protection tests carried out by FLOCH *et al.* (pp. 258, 370) on the coast and in the inland forest zone showed 17 and 35 per cent. positive, respectively, males being positive more often than females. The source is evidently the jungle

* The information from which this series of summaries has been compiled is given in the abstracts which have appeared in the *Tropical Diseases Bulletin*, 1954, v. 51. Reference to the abstracts are given under the names of the authors quoted and the pages on which the abstracts are printed.

† For previous articles on yellow fever in this series see the February issues of the *Tropical Diseases Bulletin* each year since 1939.

yellow fever of monkeys, especially *Alouatta stentor*, the howler monkey. *Aëdes aegypti* was formerly abundant on the coast, but campaigns of residual insecticide spray have eradicated it, and large-scale vaccination is being organized.

In the district of Formosa, Argentina, Carlos Ferrario (p. 909) found 9 positive and 11 doubtful results in 359 human sera tested for protective bodies against yellow fever virus. Some of the positive sera were from children under 10 years old.

Bejarano (p. 1055) has set out the results of a large number of serological tests relating to yellow fever in South American mammals.

Kirk and Haseeb (p. 168) sum up the work that has been done on testing wild and domestic animals in the Sudan for immune bodies to yellow fever. There were few positive results.

Transmission : Control of Vectors

Bejarano (p. 1055) sums up available information on the biology, distribution and taxonomy of the genera *Haemagogus* and *Aëdes* in relation to yellow fever in South America. Deane *et al.* (p. 1034) have investigated the vertical distribution of mosquitoes—including species of *Aëdes*, *Haemagogus* and *Sabethes*—in a forest area of Brazil.

Gillett and Ross (p. 566) have shown that *Aëdes strelitziae*, recently described from Natal, South Africa, is able to transmit yellow fever virus by bite, in the laboratory. It bites man readily, but to assess its real importance it would be necessary to find out if it customarily feeds on some non-human host commonly circulating the virus at high titre.

Pinto Severo and Gutiérrez (p. 1056) have prepared a useful account of the technical and administrative aspects of control of *Aëdes aegypti*. Elliott and Fitz-John (p. 52) comment that the control of *Aëdes aegypti* in West Africa by residual insecticide spray applied by hand atomizers is slow and difficult, and they write of a portable generator which provides a satisfactory insecticidal mist with BHC or DDT. With this a village house can be treated in one minute. The cost of operation is small. Certain disadvantages exist, but the report is very favourable.

Owens (p. 18) shows that *Aëdes aegypti* has largely disappeared from Central America, and in spite of the recent outbreaks of jungle yellow fever, no cases of urban yellow fever have been reported for some years.

Clinical Findings : Cross Immunity

Miranda (p. 790) in Costa Rica has treated a considerable number of patients suspected of yellow fever, and has carried out certain tests on them—bilirubin estimation, cholesterol estimation, serum protein estimation; cephalin-cholesterol, thymol, colloidal red, and colloidal gold tests. He describes the results of these at various stages of yellow fever. The flocculation tests had no prognostic value; bilirubinaemia rose as the disease advanced: serum cholesterol and serum protein fell in fatal cases.

The Uganda S virus may infect man, and this infection is relatively common in Southern Nigeria. MacNamara (p. 51) has shown in animals that there is a low degree of cross-relationship between this and the yellow fever virus. A considerable increase in the neutralization index to Uganda S has been observed in convalescent-phase sera of patients after attacks of undoubted yellow fever, compared with sera of the acute phase. It seems likely that previous Uganda S infection may modify subsequent yellow fever.

Immunization

The World Health Organization (p. 166) has issued information on international certificates of vaccination against yellow fever. The publication deals with designated centres for the issue of valid certificates, the vaccines approved by WHO, the vaccine testing stations, the international certificates of immunity, and an index of the 117 countries in which the 855 vaccinating centres are distributed.

Cannon and Dewhurst (p. 567) show that the 17D yellow fever vaccine produced at Yaba, Nigeria, is an efficient immunizing agent, especially when administered by inoculation. Tests of its efficacy after administration by scarification indicated that if the arms of the subjects were cleansed with water before administration, 80 per cent. or more of positive results could be expected, but the rate was significantly reduced when ether was used as a cleansing agent, though the explanation is not clear. It made little difference whether the suspending fluid for the scarification method was water or gum acacia diluent.

Courtois (p. 1055) found immunity in 96 per cent. of 79 persons vaccinated for yellow fever 12 years previously with vaccine supplied in 1941 by the Rockefeller Foundation, Entebbe. He therefore suggests that the validity of certificates of vaccination should be extended to 9 years.

The subject of encephalitis after yellow fever vaccination is of growing importance. Eklund (p. 483) reports a series of cases, mostly in children, from Costa Rica and Honduras; most of them were associated with one of several batches of the Dakar vaccine, and as the immunological results with this batch were relatively poor, and the titre of virus low, it seems likely that, as in the classical experiments of Theiler and Whitman, the extraneural inoculation of very minute amounts of virus is more likely to cause encephalitis than inoculation of larger amounts.

Reagan *et al.* (p. 566) report electron microscope studies of virus 17D, which are criticized, in comment, by Dick. The particle size of the 17D virus is stated to be 29·2 to 31·4 mμ (Polson, p. 1055).

Charles Wilcocks

MALARIA

In this section abstracts are arranged as far as possible in the following order:—Human malaria—*epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control;* Animal malaria—*monkeys, other animals, birds.*

Colbourne, M. J. & Edington, G. M. **Mortality from Malaria in Accra.** *J. Trop. Med. & Hyg.* 1954, Sept., v. 57, No. 9, 203–10, 3 figs. [10 refs.]

Deaths are registered in Accra together with a certificate of cause, though the latter varies considerably in quality. The authors analyse some age specific mortalities for a period of 5 consecutive years and in 3 areas of Accra together with the rates attributed to malaria. In summary the average figures for all years and areas are:—

Age	*Death rates due to:*	
	All causes	*Malaria*
Under 1 year	118·5	16·8
1–5 years (*sic*)	30·8	10·0
5–15 years (*sic*)	5·3	1·5
All ages	18·7	2·3

The rates attributed to malaria are examined in relation to climatic changes, autopsy findings and malaria incidence as shown by survey, and it is concluded that they are reasonably correct. With this background, figures indicate that in the more malarious parts of the town the disease causes a high death rate in infants but a lesser rate in the child groups than is encountered in the more moderately malarious zones. It is postulated that the experience in infancy, though causing many deaths, gives a protective immunity in the later years. The figures suggest that in total, malaria is a more important cause of death in the less malarious part of the town, though this takes no account of the possibility of this being a major contributory—though not primary—cause of mortality in the former areas. It is impossible to forecast the effect of control on mortality. [Whatever the cause of mortality the figures indicate total rates which must appal the health authorities and prevent any complacency about the health of the town. The death rate in the 1–5 age group is 25 times that of the same group in England and Wales (1·2) and that in the next group, 5–15, is 11 times the figure for England and Wales (0·49). The United Nations Demographic Year Book shows less than half a dozen countries in which these figures are equalled or exceeded, the nature of the age grouping making exact comparison impossible. For studies in Nigeria, see Bruce-Chwatt, this *Bulletin*, 1953, v. 50, 596.] *G. Macdonald*

Saliternik, Z. **A Comparison between the Monthly Incidence of Primary Malaria Cases in Israel in the Years 1923–1925 and 1950–1952.** *Documenta Med. Geograph. et Trop.* Amsterdam. 1954, Sept., v. 6, No. 3, 247–51, 3 graphs.

Pre-war malaria in Israel occurred in 2 waves with their peaks in July and November. It is now greatly reduced in volume but such as there is occurs as a single epidemic in October. This change reflects the changing anopheline pattern; *Anopheles sacharovi* which was largely responsible for the summer wave in the coastal zones has now nearly disappeared, while *A. superpictus* which causes the summer wave in the hill areas has been greatly reduced. However, the breeding of *A. sergenti* has increased all over the country since the development of irrigation and fishponds and it is little affected by residual DDT. The September–October peak attributable to this anopheline therefore remains. *G. Macdonald*

Pringle, G. **A Summary of Malaria and Malaria Control in Iraq before 1946.** *Bull. Endem. Dis.* Baghdad. 1954, July, v. 1, No. 1, 2–45, 16 diagrams (5 coloured on 3 pls.) & 1 map.

The author collates all available information on the incidence of malaria in Iraq from the time of its first technical study in 1916–19 [Christophers and Shortt, this *Bulletin*, 1921, v. 18, 325] to the end of the second period of military interest in 1946, for which the entomological data were recorded by Macan [*ibid.*, 1951, v. 48, 103]. In the first period the plains of Iraq had proved no more than mildly malarious; the incidence among troops was low and mainly due to *Plasmodium vivax*, recorded spleen rates were low

and many areas non-malarious. An alteration was dramatically demonstrated by heavy incidence in the first troops to land in May 1941, and subsequent experience showed that the picture had quite changed.

In the hills and foothills to the north and east malaria is carried mainly by *Anopheles maculipennis* and *A. superpictus* and is quite stable. It occurs as regular prolonged summer epidemics caused by both *P. vivax* and *P. falciparum*, and has altered little if at all during the 30 years reviewed. To the west and south lie the alluvial plains of the Euphrates and Tigris and of their conjunction, the Shatt-el-Arab. The primary vector is *A. stephensi* supported in the Shatt-el-Arab area by *A. sacharovi*. Malaria here is very unstable. In 1916–19 it was at a low ebb but recurrences starting soon after culminated in a serious epidemic in 1926, the decline of which was followed by a second in 1936 which continued until it reached its height in 1940–41. The epidemics are related, though not quite consistently, to the height of river floods and it may be that malaria here has a cyclical periodicity with about a 10-year interval. It seems also that there is a progressive deterioration and malaria is establishing itself more firmly in the inter-epidemic periods especially in the south, while the foci of continuous high endemicity are becoming more numerous. *P. falciparum* has become common, and spleen rates in this area are much higher than in 1916–19. The disease typically occurs in two peaks reaching their heights in June and October–November, a distribution in alignment with the prevalence of larval *A. stephensi*. It is the first of these peaks which is exaggerated in epidemic times. The progressive increase apart from the epidemic oscillation is largely attributable to developing irrigation schemes often without associated drainage, and to the closure of various subsidiary out-flows of flood water to the sea, concentrating them into the Shatt-el-Arab and thereby raising ground-water level.

Between the hills and the alluvial plains lies the steppe area where transmission, primarily by *A. superpictus*, is most marked in June–July; the disease appears to be relatively stable but has decreased in several townships following particularly the installation of piped water supplies in place of leaking channels.

The various efforts at control in this period are reviewed. The most effective and often unintentional method has been the provision of piped water supplies in the *A. superpictus* area, whereas the common filling of allegedly dangerous breeding places near towns in the alluvial zone has often been misguided and useless. Wholesale interference with irrigation cannot be considered but minor modifications could in some cases be beneficial and all irrigation schemes should be associated with drainage.

[Although much of the data is necessarily fragmentary this paper gives a coherent and consecutive account of the epidemiology of malaria in Iraq. There are many gaps to be filled but the picture is the first full one of this area. Its quality augurs well for the newly launched journal in which it is published.] *G. Macdonald*

Jeffery, G. M.; Young, M. D.; Wilcox, Aimee. **The Donaldson Strain of Malaria. 1. History and Characteristics of the Infection in Man** [Jeffery, Young & Wilcox]. *Amer. J. Trop. Med. & Hyg.* 1954, July, v. 3, No. 4, 628–37. [10 refs.] **2. Morphology of the Erythrocytic Parasites** [Wilcox, Jeffery & Young]. *Ibid.*, 638–49, 4 pls. **3. The Infection in the Mosquito** [Jeffery]. *Ibid.*, 651–9, 1 fig. **4. An Evaluation and Status** [Jeffery & Young]. *Ibid.*, 660–64.

i. This series of papers presents a complete account from all angles of a strain of a malaria parasite which was finally established as being *Plas-*

modium ovale. The first paper deals with the clinical characters. The strain—designated the Donaldson strain—was isolated from the blood of Dr. A. W. Donaldson of the U.S. Public Health Service, who had contracted the infection 4 years earlier, probably in Luzon in the Philippines. He had been on suppressive mepacrine at the time of his residence in the islands, and the first attack of fever (treated with sulphadiazine) did not appear until 4 months after the drug was stopped; a relapse (treated with mepacrine) occurred 11 months after the primary attack, followed by (untreated) parasite recurrences over the next year, and by two further relapses (the second of which was terminated by chloroquine) during the ensuing 2 years. The strain was taken during this last and final relapse, and has been maintained—by blood or mosquito infection—in 125 neurosyphilitic patients. These included Negroes and whites and both races were found to be equally susceptible.

The pre-patent period (following a mean of 15 infective bites) was seen to lie between 12 and 20 days (mean 15·3 days) and symptoms appeared 2 days later. The pre-patent period was found to be about 2 days longer than that of the St. Elizabeth strain of *P. vivax* and nearly 4 days longer than the Chesson strain. The paroxysms were usually mild and few in number (about 8) and were often unaccompanied by rigors. Their periodicity was irregular and often quotidian, though in a minority of cases tertian fever occurred. The interval between the tertian peaks was on an average 49·5 hours—5 or 6 hours longer than with the strains of *P. vivax*. The infections responded very quickly to all antimalarial drugs. Without treatment, parasites in low numbers persisted in the blood up to 89 days; true relapses were rare, one occurred 148 days after the original attack (treated early with chloroquine), and another, 235 days. The latter was followed by a parasite relapse 152 days later still. Patients who had recovered from this form of malaria were inoculated with the Chesson strain of *P. vivax* and practically no cross-immunity was demonstrable; the result was the same when the *P. vivax* was used first. There was equally no cross-immunity between the Donaldson strain and *P. falciparum* or *P. malariae*.

ii. The morphology of the Donaldson strain of *Plasmodium ovale* was studied, and compared with the blood forms of *P. vivax* (Chesson and St. Elizabeth strains). The parasites were stained by the long Giemsa method, and for observations on pigment, 0·5 per cent. of Triton X-30 was added to the stain and the films were subsequently washed with distilled water containing Triton for an hour. The ring stage caused no enlargement of the erythrocyte, and older parasites only enlarged the corpuscle by about 27 per cent. as compared with the 50 per cent. or more enlargement of *P. vivax*-infected cells. But distortion of the *ovale*-infected corpuscle was common—35 per cent. became elliptical and 16 per cent. were long, narrow and oval; in the case of red blood cells containing gametocytes, the alteration in contour was even greater, 50 per cent. becoming elongate and 25 per cent. actually fimbriated. Schüffner's dots were prominent in infected cells, and appeared earlier than in *P. vivax* infections, though only 60 per cent. of ring forms were accompanied by stippling. The ring forms were compact and not at all amoeboid; later the parasite remained round, and pigment granules (yellow-brown to deep grey-brown in colour) were fewer than in *P. vivax*. Some clumping of pigment took place in the mature schizont and occasionally a peripheral arrangement occurred. Merozoites were counted in 700 mature schizonts and the average number was found to be 7·8; only 3 per cent. of schizonts contained over 12 merozoites. Gametocytes were rather scanty; they much resembled those of *P. vivax* but

were usually smaller. The authors conclude that in general morphology the blood parasites of the Donaldson strain are most like *P. ovale* and differ greatly from the two strains of *P. vivax*.

iii. The infection of the Donaldson strain of malaria was studied in 3 strains of mosquitoes (*Anopheles quadrimaculatus*, *A. albimanus* Panama strain, and *A. albimanus* Florida Keys strain). The mosquitoes were fed in batches of 100 on a carrier, and were then maintained at a temperature of 74°–79°F. The oöcyst rate was determined on the twelfth day after feeding. All three types of mosquitoes became infected, but the results were irregular and unpredictable. The relative susceptibility could be expressed as follows:—*A. quadrimaculatus* 100, *A. albimanus* (Florida) 77, and *A. albimanus* (Panama) 46—the actual infectivity rate being about 50 per cent. in the case of *A. quadrimaculatus*. An attempt was made to determine the days in the infection when a patient was most infective to mosquitoes, but no stable pattern was detectable; there were indications, however, that in the case of sporozoite-induced attacks, the 5–9th, 13–19th, and 20–35th days, and of blood-induced attacks, the 3–9th, and 18–24th days were the most productive periods. The density of male gametocytes gave the best guide to the infectivity of a carrier, but even this was by no means certain. The general low infectivity of the strain was noted. The average length of cycle in the mosquito was 15 days. The pigment in the oöcyst was arranged in the X pattern in 38 per cent.; it was dark in colour, small in quantity and almost always linear in distribution.

All these observations confirm that the Donaldson strain is *Plasmodium ovale*.

iv. This paper sums up the data presented in the 3 preceding ones, and in a table compares the characters of the Donaldson strain with those of *Plasmodium vivax* and *P. ovale* (as reported in the literature and from examination of blood films sent to the authors by Mr. P. G. Shute). The conclusion is reached that the Donaldson strain is *P. ovale*, and that this is probably the first record of the species in the United States. The facts that Negroes and whites are both susceptible, and that local species of *Anopheles* are easily infected, suggest that *P. ovale* could be established in North America under suitable conditions. *P. C. C. Garnham*

Belkin, J. N. **Simple Larval and Adult Mosquito Indexes for Routine Mosquito Control Operations.** *Mosquito News.* 1954, Sept., v. 14, No. 3, 127–31.

The estimation of the amount of mosquito breeding from larval incidence in an area depends in the present, as in other systems, on systematic dipping for larvae in breeding places. The special system of sampling and computation advocated by the author is described in detail for larvae, with data from actual field work to illustrate the results obtained. But as regards adult mosquitoes the paper only suggests that a similar system could be applied to adult catches in premises or on baitmen; this has not, however, been tried. *D. S. Bertram*

Grjebine, A., Eyquem, A. & Fine, J. Utilisation des hémagglutinines pour l'identification de l'origine spécifique des hématies ingérées par les moustiques hématophages. [**Haemagglutination in the Identification of Blood Meals of Mosquitoes**] *Ann. Inst. Pasteur.* 1954, June, v. 86, No. 6, 741–51, 3 figs.

A method of identification of blood meals of mosquitoes is described which depends on the agglutination of the erythrocytes present in the blood meal

of the insect in the presence of haemagglutinating antisera prepared against the red blood cells of the homologous species. These antisera were rendered specific by absorption with the red blood cells of species of animals which cross reacted with the antisera. Fresh blood meals dissected from the stomach contained sufficient blood cells for agglutination to occur in the presence of the antiserum. The authors claim that they have obtained positive reactions (in 4 cases) 12 hours after feeding. The sensitivity of the test, from the little material published, appears to be relatively low. No references to other published work on this subject are given.

[This test is not suitable for the identification of smears dried on filter paper owing to the deterioration of the red blood cells which occurs on drying, and it is a laborious test to carry out in field conditions from freshly caught mosquitoes. Apparently the authors could have saved themselves a great deal of work by reference to the current literature which leaves no doubt of the superiority of the precipitin test as regards sensitivity, specificity and simplicity of performance, while there appears to be no gain from the use of the technique described. Moreover, the preparation of haemagglutinating antiserum against species other than laboratory or domestic animals and man from fresh red blood cells would offer in practice insurmountable difficulties.] *Bernard Weitz*

Holstein, M. H. **Biology of** *Anopheles gambiae*. **Research in French West Africa.** *World Health Organization Monograph Series No. 9.* 172 pp. 22 figs. [410 refs.] 1954. Geneva: Palais des Nations. [13s. 6d.; $2.00; Sw.fr. 8.–.]

This is an English translation of the original monograph which was published in 1952 and which was reviewed in this *Bulletin*, 1953, v. 50, 360.

A few changes are noted; they are the omission of the French and English summaries and the addition of some notes and amendments derived from works published since August 1952, the titles of which have been added to the bibliography, increasing the number of references to 410.

These additions merely supplement the evidence already examined (a) concerning aspects of the biology of *Anopheles gambiae* which have a bearing on malaria control by means of modern insecticides and (b) concerning the existence of different forms of this species; but in view of the uncertain systematic position of these forms they are not named. It is noticed that they are referred to as " populations ".

Thus the conclusion remains unaltered, that the malariologist must be prepared to have to deal with both zoophilic as well as anthropophilic populations, for the zoophilic populations, " owing to their ability to cross with anthropophilic populations and to feed on man, should the occasion arise, are a factor in the spread of malaria which must not be neglected ". *H. S. Leeson*

Christie, M. **A Method for the Numerical Study of Larval Populations of** *Anopheles gambiae* **and other Pool-Breeding Mosquitoes.** *Ann. Trop. Med. & Parasit.* 1954, Sept., v. 48, No. 3, 271–6, 1 diagram.

A description is given of an apparatus offering possibilities of quantitative sampling for larvae of *Anopheles gambiae*, other than first-stage larvae, which is thought to be superior to systematic dipping or counts over fixed areas. It enables the field worker to extract, by pump or bucket, all the water from a breeding place and pass it through graded sieves of 5, 16, 60

and 80 meshes to the linear inch to separate the different anopheline stages and other fauna of the pool. These sieves are inserted one within the other and, while the sieving is in progress the sieves are kept half an inch above each other and the height of water in the water-jacket is always about an inch higher than the upper sieve. The larvae are, therefore, not stranded on the sieves except for the moment when each sieve is finally removed, inverted, and the larvae and other creatures restrained by it washed off by water on to a dish for counting.

Tests of the technique were carried out as follows: 4 pools were emptied and treated in this way and the water and known numbers (100 to 330) of second-, third-, and fourth-stage larvae were returned to it, steps being taken to avoid returning first-stage larvae by sieving the water through a 120-mesh screen. Four hours later the pools were emptied again and the larvae counted. The percentage recovered varied from 94·5 to 97·1 per cent. of those put back and included 12 pupae. Another test of the value of washing out pools with the pool water after the larvae had been removed shows that the bulk of the larvae are obtained in the initial removal of the pool's contents. [One extra washing seems to be worth while.]

In discussion, the potentialities of the method are set out. Since all the free water is removed with the larvae and then returned with them after the counting is done, there seems to be opportunity to modify selected constituent features of the breeding place by removing them from the water before returning it to the pool. And besides other problems for which it seems suited, the method may be of real value in searching for breeding, especially if very rare and slight, in a mosquito eradication scheme.

D. S. Bertram

Davidson, G. **Estimation of the Survival-Rate of Anopheline Mosquitoes in Nature.** [Correspondence.] *Nature*. 1954, Oct. 23, v. 174, 792–3, 1 fig.

The daily survival-rate of wild mosquitoes (*A. gambiae* and *A. funestus*) in Africa has been estimated from the ratio of their sporozoite-rate immediately on capture and the sporozoite-rate in those kept until the completion of the extrinsic cycle [this *Bulletin*, 1954, v. 51, 456]. This paper considers the possibility of a more direct method based on changes in the diameter of the ampulla of the oviduct due to ovarian development and oviposition [this *Bulletin*, 1933, v. 30, 304]. A table, derived from dissections of colony *A. gambiae*, shows changes in ampullar diameter from 124 μ for unfed new females to 242 μ at stage V of the eggs prior to the first oviposition. In parous females the diameter ranged from 265 μ after first oviposition to 279 μ after a second, the eggs being at stage II in both cases. The median values are also given and are, in sequence as above, 120, 240, 264 and 280 μ. (Distilled water is the preferred medium for dissections.) There is considerable overlap of the distribution curves for ampullar size in mosquitoes (*A. gambiae*) at the same ovarian stage but in different gonotrophic cycles. But, as a graph for stage III ovaries of *A. gambiae* in the first and second cycles shows, few of the lower values for ampullar size in the second cycle are less than the median value for ampullar size at the corresponding stage in the first cycle (median = 200 μ).

It is not considered necessary to examine dissections of all wild-caught mosquitoes. It is sufficient to concentrate on determining the ampullar diameters at one stage only of ovarian development and, for *A. gambiae* in Africa, stage III is suggested as a suitably common phase found in daytime catches.

The mathematical basis of the procedure for determining the daily survival-rate p from ampullar size is set out and reduces to the expression $p = \sqrt{\text{proportion of parous mosquitoes.}}$ This applies to a mosquito species with a gonotrophic cycle of two days. If the cycle is a three-day one, the survival rate is the cube root of the proportion of parous mosquitoes.

A test of some data for *A. gambiae* resulted in survival rates of 0·94 and 0·95 if the data for all stages of ovarian development from II to V were utilized and 0·91 and 0·93 if estimation were based on stage III ovaries only. These results compare favourably with survival rates of 0·93 and 0·97 calculated from immediate and delayed sporozoite rates.

In practice, the method requires first that data for the median and the range of ampullar diameter for nulliparous and parous mosquitoes in the same ovarian stage (stage III is suggested) be derived from mosquitoes of known history since emergence; for example, from those of a laboratory colony. Secondly, the gonotrophic cycle should be known. With regard to assessing the proportion of nulliparous and parous females in collections of mosquitoes in nature, it is thought that twice the number of females with ampullar size smaller than the known median ampullar size derived from bred nulliparous females is a satisfactory value for the total number of nulliparous present in the total wild catch. The proportion of parous females is then obtained simply by subtracting the number of nulliparous thus obtained from the total catch. (And, as noted, this work can be restricted to only those mosquitoes with a particular ovarian stage, *e.g.*, stage III.) The value for p as the square root, or the cube root as the case may be, of the proportion of parous females is then readily worked out. This method of determining the number of nulliparous females requires, however, satisfactory evidence for the species of mosquito under study that no, or few, individuals among parous females have ampullar sizes less than the median value for nulliparous females of corresponding ovarian stage. The curves established from dissections of females of known history are the means of satisfying this point. The whole method assumes that a mosquito population is fairly stable. The observations would probably best be continued over several consecutive days. *D. S. Bertram*

See also p. 215, Lee *et al.*, **The Blood Sources of some Australian Mosquitoes.**

Jeffery, G. M., Burgess, R. W. & Eyles, D. E. **Susceptibility of *Anopheles quadrimaculatus* and *A. albimanus* to Domestic and Foreign Strains of *Plasmodium vivax*.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 821–4.

"The relative susceptibility of *Anopheles quadrimaculatus* and two strains of *A. albimanus* (Panama and Florida Keys strains) to three strains of *Plasmodium vivax* was determined. The strains of *vivax* included a U.S. strain (St. Elizabeth), a New Guinea strain (Chesson), and *vivax* of Korean origin.

"In all cases *A. quadrimaculatus* showed a high degree of susceptibility, while the two strains of *albimanus* either were completely non-susceptible, as in the Korean *vivax*, or became infected only occasionally and at a very low rate.

"The infectivity of Korean *vivax* to *A. quadrimaculatus* and transmission through that species, confirms the possibility of establishment of malaria from that area in this country."

Sun, S. F. & Lev, L. F. **Quinine Amblyopia.** *Chinese Med. J.* Peking. 1954, July–Aug., v. 72, No. 4, 319–24, 1 fig. [17 refs.]

Report of a case.

Clark, H. C. **The Suppressive Treatment of Naturally Acquired Malaria in a Rural Village with Pyrimethamine (Daraprim).** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 831–2.

The author attempted suppression of malaria with pyrimethamine in a village in Panama where no forms of antimalarial control had been used. There were 47 proved cases of malaria among 134 persons (49 adults and 85 children). The parasites concerned were *P. falciparum* (23), *P. vivax* (21) and mixed (3).

The dosage was 25 mgm. weekly for 18 weeks to adults and children over 2 years and half this dosage for younger children.

After 3 weekly treatments, all were negative for asexual parasites, but 12 persons showed gametocytes of *P. falciparum* for 2 to 6 weeks. At the end of the 18 weeks, all were free of parasites. No symptoms or relapses occurred after the third week. Most of those in whom gametocytes had persisted were children under 2.

The drug, which is almost tasteless, was well tolerated and could be given to infants as crushed tablets followed by a drink of water. There were no toxic effects noticed.

Two "irregular visitors" with *P. vivax* infections had 3 weekly treatments only, after which a few gametocytes were found.

The author obtained the same results with chloroquine as he did with pyrimethamine, but found pyrimethamine easier to administer. He considers it to be a good suppressive if it is repeated weekly.

H. J. O'D. Burke-Gaffney

Mandoul, R. & Rejenet, J. Quelques enseignements tirés de l'assainissement de l'oasis palustre de Ouargla (Sahara algérien). [**Some Lessons to be drawn from the Sanitary Reclamation of Ouargla, a Malarial Oasis in the Algerian Sahara**] *Bull. Soc. Path. Exot.* 1954, v. 47, No. 3, 443–52, 2 figs.

In a previous publication [this *Bulletin*, 1952, v. 49, 233] a graphic account was given of Ouargla, the largest oasis of the Algerian Sahara, of the comprehensive antimalaria campaign that was started there in 1949, and of the spectacular results achieved. The present progress report gives further information about the achievement and indicates some of the lessons that can be drawn after 5 years of sustained effort.

Antilarval measures have received unremitting attention. Since the end of 1951 there has been no malaria morbidity, and there are no malaria parasite carriers among the settled population. Mosquitoes of all kinds have practically disappeared. The cessation of chemoprophylaxis has recently been decided on. Neither residual spraying with insecticides nor chemoprophylaxis has contributed significantly to the success of the campaign, which has been almost exclusively due to antilarval measures—drainage, the stocking of residual collections of water with *Gambusia*, and the use of a liquid larvicide.

Constant vigilance will always be necessary if Ouargla is to remain free from malaria: nomads frequently camp on the outskirts of the oasis and there is always the possibility of the reintroduction of anophelines by

motorcars, lorries or aircraft. The indigenous population has lost the premunition it once possessed. *Norman White*

GARTRELL, F. E. & LUDVIK, G. F. **The Role of Insecticides in the TVA Malaria Control Program.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 817–20. [12 refs.]

The primary methods of mosquito control in the Tennessee Valley Authority [TVA] area have been water level management, shoreline improvement, aquatic plant control and larviciding. The use of insecticides has been restricted, as far as possible, to zones where the other methods are not feasible. After extensive tests in 1947 to 1949, the larviciding was done by spraying DDT from aircraft, a method which was found more effective than aerial application of aerosols. As a result of permanent shoreline improvement measures, the area which has to be treated in this way was reduced from 95,000 acres in 1938 to 4,600 acres in 1953, in one reservoir.

In addition to larvicidal measures, a limited amount of house-spraying with DDT was done from 1945 to 1950 in some areas.

As a result of this extensive use of DDT for several years, there has been some evidence of increased resistance in the mosquito *A. quadrimaculatus* [see KRUSE *et al.*; this *Bulletin*, 1953, v. 50, 383]. This is illustrated by results of bioassay tests of the effectiveness of air spraying in various years. [It appears that laboratory-reared larvae were exposed to the air spray at various points and the lethal effect was compared with the (?) chemically estimated deposit.]

Year	Deposit of DDT for 90% kill lb./acre	Ratio to 1944
1944	0·0005	1
1946	0·0021	4
1949	0·0019	3·8
1950	0·0200	40
1951	0·1300	260

In spite of the big change in susceptibility to be inferred from these data, in practice it was only found necessary to raise the rate of application from the aircraft from 0·05 lb./acre to 0·1 lb./acre for effective control.

At the same time there was some evidence of increased resistance in the DDT-sprayed houses. Mosquitoes released in them in 1944 were all knocked down in 1½ hours and all dead in 24 hours. In 1950, only 75 per cent. were down after 4½ hours and 85 per cent. were dead after 24 hours. In later years it was generally observed that larger numbers of mosquitoes escaped to window traps in treated houses in the sprayed zones than in unsprayed areas. *J. R. Busvine*

SAUTET, J. & ALDIGHIERI, R. La lutte contre le paludisme et celle contre la fièvre jaune doivent-elles être toujours dissociées? Quelques exemples guadeloupéens. [**Should Control Measures against Malaria and Yellow Fever always be Separate? Some Examples from Guadeloupe**] *Bull. Soc. Path. Exot.* 1954, v. 47, No. 3, 387–91.

Malaria in the West Indian island of Guadeloupe, transmitted by *Anopheles aquasalis*, *A. albimanus* and *A. argyritarsis*, has been the subject

of a control programme since December 1950. The intensity of effort and regularity of application of insecticide have varied with the local severity of malaria. The *Aëdes aegypti* index has been consistently reduced to zero only in those parts of the island where the antimalaria measures have been systematic and completely regular. The programme appears to have consisted in the use of residual DDT and of larvicides applied to water-courses, marshes, etc., in the neighbourhood of houses, but without the application of the larvicides to the strictly domestic type of water favoured by *Aëdes aegypti*. In places where mild malaria has been adequately controlled by a less intensive or less regular campaign the *Aëdes aegypti* index has remained quite unaltered. The authors conclude that the control of *Aëdes* and of malaria should always be associated under the same direction but that the necessity for specific measures directed against *Aëdes* must depend on the intensity of the effort to control anophelines. *G. Macdonald*

Adler, S. [**Remarks on the Classification and Nomenclature of Malaria Parasites**] *Harefuah*. Jerusalem. 1954, Oct. 15, v. 47, No. 8 [in Hebrew 157–8. (15 refs.) English summary 158–9.].

The English summary appended to the paper is as follows:—

"The facts relating to the discovery of the extra-erythrocytic cycle in the *Plasmodiidae* and *Haemoproteidae* are briefly reviewed and the obvious analogies between the known life cycles in these two families, particularly in the vertebrate hosts, are stressed. In the *Haemoproteidae* the gametocytes are derived directly from E. E. forms in the tissues. In *Plasmodium gallinaceum* gametocytes are also derived directly from E. E. forms and in this respect *P. gallinaceum* resembles *Haemoproteus*. Garnham discovered the development of the E. E. forms of *Hepatocystis kochi* (syn. *Plasmodium kochi*) in the liver parenchyma of monkeys, and this important finding was followed by the discovery of the E. E. forms of the human malaria parasites and of *P. cynomolgi* and *P. inui* in the parenchyma of the liver. In the classification of the *Haemoproteidae* the primary character employed is the site and type of the development of E. E. forms. In all genera, except *Leucocytozoon*, the gametocytes develop in erythrocytes and produce malaria pigment as in the *Plasmodiidae*. The *Haemoproteidae* include the following genera: *Haemoproteus*, parasites of birds with E. E. confined to forms in the R. E. system; *Polychromophilus*, parasites of bats with E. E. forms in the R. E. system; *Hepatocystis*, parasites of monkeys, with E. E. forms in the parenchyma of the liver, and recently (1953) Garnham and Heisch have designated the genus *Nycteria* for a parasite of bats with E. E. forms in the parenchyma of the liver.

"The family *Plasmodiidae* so far contains one genus *Plasmodium*, but if the method used in the closely related family *Haemoproteidae* is carried to its logical conclusion, and the site and type of development of E. E. forms is used as a crucial character, it is logically feasible to divide the family *Plasmodiidae* into a number of genera. In bird malaria there are two types of E. E. development typified by *P. elongatum* in all the cells of the haemopoietic system and by *P. gallinaceum* in the R. E. system. In human malarias and *P. cynomolgi* the E. E. forms develop in the parenchyma of liver and the various species show general and specific differences in the details of this development. These facts may serve as a logical basis for dividing the genus *Plasmodium* into a number of genera in accordance with the method applied in the *Haemoproteidae*. Another alternative would be to include all the genera of the *Haemoproteidae* except

Leucocytozoon in a single genus *Haemoproteus*. No new names are created but the problem is posed for discussion.

"The analogies between the life cycles of intestinal *Coccidia* and the *Plasmodiidae* and *Haemoproteidae* are obvious. In this connection it should be noted that Tyzzer (1929) who worked out the life cycle of *Eimeria tenella* in detail found a succession of different types of schizogony following the invasion of an epithelial cell by a sporozoite and he named the types schizonts of the first generation and schizonts of the second and subsequent generations. This terminology corresponds to the cryptozoites and metacryptozoits of Huff et al. It is probable that a succession of different types of schizogony following invasion of parasitized cells by sporozoites such as Tyzzer described in *E. tenella* is typical for the whole order *Coccidiida*."

VAN STEENIS, P. B. *Plasmodium berghei*. *Nederl. Tijdschr. v. Geneesk.* 1954, Nov. 20, v. 98 (iv), No. 47, 3403–9.

A general account.

GREENBERG, J., NADEL, E. M. & COATNEY, G. R. **Differences in Survival of Several Inbred Strains of Mice and their Hybrids infected with** *Plasmodium berghei*. *J. Infect. Dis.* 1954, July–Aug., v. 95, No. 1, 114–16.

"Ten inbred strains of mice and nine hybrids from these strains were infected with *Plasmodium berghei*, and their survival observed. The shortest-lived strain (A/LN) survived a mean of 8·38 days, the longest-lived (C57 Black), 17·6 days. Other strains were intermediate in their survival against malaria. Most hybrids survived, on the average, longer than either parent; two hybrids (BALB/C × A/LN and C57 Black × C57 Brown) did not live longer than the longer-lived parent, and one hybrid (C57 Black × C57 Leaden) was significantly shorter-lived than either parent."

FABIANI, G. & ORFILA, J. Variations du facteur de maturation réticulocytaire au cours du paludisme expérimental de la souris. [**Variations in the Maturation Factor of Reticulocytes in the Course of** *Plasmodium berghei* **Infection in Mice**] *C.R. Soc. Biol.* 1954, Apr., v. 148, Nos. 7/8, 670–73.

In the case of rats infected with *Plasmodium berghei*, it has previously been shown [this *Bulletin*, 1953, v. 50, 482] that the progressive course of parasitaemia corresponds to an increase of reticulocytosis. In the present paper the authors describe the correlation between parasitaemia and reticulocytosis in infected mice, based on daily examinations of the blood. These studies revealed that from the 3rd day of infection, and for several days after, the reticulocytosis actually drops almost to zero, after which it rises progressively and rapidly. Nevertheless, during this period the parasitaemia not only does not diminish but actually increases, while the parasites attack mature erythrocytes, suggesting a temporary change in their selective affinity for reticulocytes.

The authors assumed that this phenomenon might be due to a more rapid and intense maturation of the reticulocytes. To test this hypothesis, they carried out experiments with the view to ascertain whether variations in the reticulocyte maturation factor could be revealed in the course of the

infection. For this purpose they studied *in vitro* the effect of mouse blood or serum on rabbit reticulocytes, on the one hand, and on ribonuclease (50 μgm.), on the other, since the latter can be regarded as the maturation factor. These tests have shown that, in the course of malarial infection, the reticulocyte maturation factor in the blood of mice varies considerably, rising rapidly and then falling abruptly, while the number of reticulocytes in the circulation varies in the opposite direction. It is concluded that the diminution of reticulocytosis in the blood is due not only to the destruction of reticulocytes in the course of schizogony of the parasite but chiefly to the more rapid maturation of the young red cells released from the bone-marrow. In the light of these observations, the apparent change in the affinities of the parasite finds a ready explanation, for it is conceivable that the merozoites, produced by the numerous schizonts in the bone-marrow, invade the reticulocytes which then rapidly mature in the blood stream. These observations also support the ribonucleic nature of the maturation factor and throw light on the enzymatic nature of the process itself.

C. A. Hoare

Fabiani, G. & Fulchiron, G. Influence de la splénectomie sur le maintien de l'immunité spécifique au cours du paludisme expérimental du rat blanc. [**Effect of Splenectomy on Specific Immunity in** *Plasmodium berghei* **Infection of Rats**] *C.R. Soc. Biol.* 1954, Apr., v. 148, Nos. 7/8, 673–5. [10 refs.]

When rats are inoculated with trophozoites of *Plasmodium berghei*, the infection runs an acute course with high parasitaemia, after which the infection subsides, becoming latent for 1–3 months, and finally disappearing. Relapses are rare and transient, but the latent infection can be revealed by splenectomy. In the present work the authors have endeavoured to define the rôle of the spleen in the maintenance of acquired immunity.

Experiments on 60 rats, which had recovered from infection with *P. berghei*, have shown that the number of relapses and their severity diminished with the length of time between recovery from the primary infection and the removal of the spleen. Though these observations show that the spleen plays a major part in the persistence of the specific immunity, they also indicate the important intervention in this process of factors outside the spleen. In short, for the acquisition of immunity this organ is indispensable, but for its maintenance it is merely useful.

C. A. Hoare

Nadel, E. M., Greenberg, J. & Coatney, G. R. **The Effect of Malaria (*Plasmodium berghei*) on Leukemia L_{1210} in Mice.** *J. Infect. Dis.* 1954, July–Aug., v. 95, No. 1, 109–13, 1 fig. [18 refs.]

Plasmodium berghei (Kasapa strain) kills mice ("BD F_1 hybrids") in 20 days; the transplantable leukaemia (L_{1210} strain) kills them in 10 days. This difference in spread makes it possible to assess the effect of combining the two diseases in these animals, 310 of which were used in 12 series of experiments; one-quarter were given the malaria just before the leukaemia, in three-quarters the administration of the infections was reversed. All animals succumbed to one or both diseases: if malaria infection preceded the leukaemia, no significant difference in the survival time was noted (10·5 days in mice with leukaemia alone, 10·7 days in mice with malaria and leukaemia); but if *P. berghei* were inoculated later, the animals lived 2 days longer than in the controls. Such mice also sometimes showed

considerably smaller tumours (641 mgm. instead of 1,007 mgm.) and smaller spleens (285 mgm. instead of 331 mgm.). Malaria has thus a slightly inhibitory effect on the leukaemia and it is tentatively suggested that this may be because both infections have similar metabolic requirements. [The authors think that the phenomenon might be further elucidated by studying the effects on different tumours and with different infections. It would probably be worth including a *Babesia* among the latter, because as Rodhain has shown (see this *Bulletin*, 1954, v. 51, 144), this type of blood parasite has quite a different metabolism.] *P. C. C. Garnham*

Rodhain, J. Essai d'adaptation du *Plasmodium vinckei* au rat blanc. [**Trials of Adaptation of** *P. vinckei* **to White Rats**] *Ann. Soc. Belge de Méd. Trop.* 1954, Apr. 30, v. 34, No. 2, 217–28.

In his original experiments, the author [see this *Bulletin*, 1953, v. 50, 913] had shown that splenectomy had little effect on the course of *Plasmodium vinckei* in white rats; now, after more than 100 passages in white mice, the strain appears to have become more virulent, for 3 splenectomized rats died after the development of an intense parasitaemia. The infection was passed from the latter to young intact rats weighing 25–32 gm. and again all died; in fact, the mortality rate of rats of 30 gm. or less was always 90 per cent. while that of rats of over 40 gm. was usually nil. The strain was subsequently maintained in young rats, but inoculation into adults demonstrated practically no enhancement of virulence, even after 23 passages. The course of fatal infections was studied, and by the fifth day 20 parasites per field, including schizonts, were observed; by the seventh day half the corpuscles were parasitized and reticulocytosis was marked. In animals which managed to survive, the reticulocytes and normoblasts were even more numerous, though invasion of these cells by parasites was uncommon. *P. C. C. Garnham*

Geigy, R. & Freyvogel, T. **On the Influence of High Altitudes on the Course of Infection of Chicken Malaria** (*P. gallinaceum*). [Miscellanea.] *Acta Tropica.* Basle. 1954, v. 11, No. 2, 167–71, 5 figs.

Working with the same strain of *Plasmodium gallinaceum*, and at the same altitudes (Basle 280 m. and Jungfrau Joch Station 3,457 m.) as Herbig-Sandreuter [this *Bulletin*, 1953, v. 50, 682], the present authors made further observations on the effect of altitude on the course of infection in fowl malaria. In addition to these observations, similar experiments were carried out in a low pressure chamber in which the atmospheric pressure (490 mm. Hg) corresponded to that on Jungfrau. Moreover, between 1951, when Herbig's experiments were made, and 1953–1954, when the present ones were made, the virulence of the *P. gallinaceum* strain has increased. This is clearly brought out in graphs relating to the 2 series, which show that the onset of parasitaemia in the latter occurred 6·6 days after inoculation instead of on the 8th day, maximum numbers of blood schizonts were attained 2 days earlier, the number of pre-erythrocytic schizonts in the liver was doubled, and death took place after 9–10 days, instead of 10–11 days.

The results of the 3 sets of experiments are given in graphs, from which it is evident that the course of the malarial infection in chicks kept under normal conditions and in the low pressure chamber at Basle was similar. On the other hand, at the Jungfrau station, while the onset of parasitaemia was but slightly delayed, the first exo-erythrocytic stages appeared one day

later, but the number of schizonts was twice as great as in the Basle controls, reaching the peak on the 10th day and beginning to decline on the 11th day. Hence it is concluded " that the decrease of the oxygen tension is not the factor responsible for the influence of high altitudes on the malaria parasites ", and " the climatically induced changes of the blood system have no direct influence " upon them.

It is suggested that the delay in the development of the sporozoites into pre-erythrocytic schizonts " can be explained only if we assume that at high altitudes the unspecific host resistance becomes markedly improved and that the RES is activated ", probably by enabling the macrophages to dispose of the phagocytosed parasites more effectively than at low altitudes.

C. A. Hoare

Herman, C. M.; Reeves, W. C.; McClure, H. E.; French, E. M.; Hammon, W. McD.; Herold, R. C.; Rosen, L.; Brookman, B. **Studies on Avian Malaria in Vectors and Hosts of Encephalitis in Kern County, California. I. Infections in Avian Hosts** [Herman, Reeves, McClure, French & Hammon]. *Amer. J. Trop. Med. & Hyg.* 1954, July, v. 3, No. 4, 676–95. [35 refs.] **II. Infections in Mosquito Vectors** [Reeves, Herold, Rosen, Brookman & Hammon]. *Ibid.*, 696–703. [12 refs.] **III. The Comparative Vector Ability of some of the Local Culicine Mosquitoes** [Rosen & Reeves]. *Ibid.*, 704–8.

I. Observations were made during 6 summers (1946 to 1951) on the incidence of *Plasmodium* in wild birds in Kern County, California. Four localities, lying in the irrigated valley floor, were particularly investigated: farmyards in Shafter, an olive grove, the wooded Hart Memorial Park and the city of Bakersfield. Birds were usually trapped and after being bled were ringed and set free; they were classified as adult, immature, and nestling. Blood smears were examined, and sub-inoculation of blood into canaries was sometimes done. The authors studied 10,459 blood smears from 8,674 birds comprising 73 species, and 10 per cent. (including 27 new host records) contained *Plasmodium*. The following species were identified, *P. elongatum*, *hexamerium*, *nucleophilum*, *polare*, *relictum*, *rouxi* and *vaughani*. The non-migratory English sparrows and house finches were most frequently parasitized. *P. relictum* was by far the commonest parasite and several strains were thought to exist. *P. elongatum* was only identified with certainty in house finches and the diagnosis was confirmed by inoculation of blood into canaries. [The identification of *P. rouxi* in a Brewer blackbird and white-crowned sparrows is open to some doubt, as this is an Old World species, hitherto only found in Algeria and Egypt. The diagnosis was apparently not confirmed by sub-inoculation.] Repeated smears from the same bird rarely yielded a positive finding if the blood had been negative at first, but sub-inoculation of blood into canaries more than doubled the chances of detecting an infection. Most infections in the wild birds were apparently patent for short periods and were followed by long periods of latency; in canaries, the infection was often fatal (*e.g.*, 31 deaths in 111 birds). Nestlings as young as 8 days were found to be infected. The incidence of the disease varied from year to year, and each season reached a peak in July and August, though *P. relictum* in house finches was highly prevalent even earlier. There was a marked difference in infection rates in the 4 localities studied, with the urban giving the lowest figures.

II. Natural malaria infections in wild mosquitoes were studied in Kern County, California, during the summers of the years 1946, 1947, 1949 and 1950. They were collected from natural resting places in an olive grove, Hart Memorial Park, Shafter farming area and Smoot's ranch, and were dissected at least 24 hours later. In 3,364 mosquitoes examined, only 3 species were found to be infected. These were *Culex tarsalis* (9·6 per cent.), *C. stigmatosoma* (15·6 per cent.) and *C. fatigans* (1·9 per cent.). A great variation in infectivity rates was observed in different years and in the 4 localities, which was thought to be due to climatic factors and to mosquito control measures. Sporozoites from *C. tarsalis* were inoculated into canaries and on 6 occasions gave rise to *Plasmodium relictum* infections; sporozoites from *C. stigmatosoma* gave similar results on 3 occasions. [The species of sporozoite was apparently only determined by inoculation into canaries. Their probable avian origin would easily have been elicited if their morphology (size and shape) had been examined.]

III. Local species of mosquitoes were reared in the laboratory from larvae and pupae, and were then allowed to feed on canaries infected with local strains of *Plasmodium relictum*. The mosquitoes were subsequently kept in a room where the temperature was above 30°C. for most of the day; 98 per cent. *Culex tarsalis*, 100 per cent. *C. stigmatosoma* and 50 per cent. *C. fatigans* became infected. The last species always showed a lower oöcyst rate than that of the others. Species of *Aëdes* failed to become infected, except for one solitary specimen. All three incriminated species of *Culex* transmitted the infection to canaries by bite, the prepatent period usually being not more than 4 to 6 days. Although no transmissions of *P. elongatum* were obtained, it is stated that Herman in unpublished work has noted a long prepatent period in canaries infected with local strains of this species.

The great interest of this paper is the discovery that sporozoites reached the salivary glands of one *C. tarsalis* in as short a time as 4 days after feeding, and in 9 others in 5 days. [These figures almost parallel those of the inexplicably short cycle of *Leucocytozoon* in *Simulium* (see Fallis *et al.*, this *Bulletin*, 1952, v. 49, 488), and further details of the size and growth of the oöcysts would have been invaluable.] *P. C. C. Garnham*

TRYPANOSOMIASIS

In this section abstracts are arranged as far as possible in the following order:—African—*human, animal;* American—*Chagas's disease and other trypanosome infections. In each form the following order is followed*:—*epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control.*

West African Institute for Trypanosomiasis Research. **Annual Report 1953** [Mulligan, H. W., Director]. 64 pp. [1954.]

The present Report is easy to read and full of interest. A considerable part of it deals with matters of veterinary interest and we are glad to see that the emphasis is distributed in that way. But for purposes of this *Bulletin* we propose to concentrate on those parts of the Report which are more closely related to human medicine; we may remark that the veterinary work, especially that on *T. vivax* is full of interest and value.

Several strains of *T. gambiense* are maintained and attempts have been

made to transmit them cyclically through *G. palpalis*, but with only occasional success. Experiments are in hand to determine the temperatures at which the adult flies and the pupae should be kept in order to secure the most frequent cyclical transmission. Such work, apart from its convenience in the laboratory, might indicate the existence of seasons in the field during which transmission is more likely to occur. In order to facilitate diagnosis of human cases attempts have been made to develop methods of cultivating *T. gambiense*; also of defining abnormal proteins in the cerebrospinal fluid, the presence of which might indicate infection; blood proteins are also under examination. It seems that the sleeping sickness patient has a rather high value for total serum protein, which is due to the fact that his serum globulin is almost twice the normal; this increase is due almost entirely to *gamma* globulin. The figures appear tc be well established and adequate controls from people from the same area have been examined.

The drug Melarsen has been tested on 200 cases of sleeping sickness. The Report defines several schemes of dosage which have been tested, and describes toxic effects which may be attributed to the drug. Most of these symptoms were minor and it is recorded that no cases of blindness or dimness of vision were observed. Two of the patients died showing cerebral symptoms which might have been due to an arsenical encephalopathy, but two other patients exhibited similar symptoms and died before they were treated. It is recorded that the drug is easy to give and generally well tolerated. Clinical *impressions* [italics in original] are favourable and Melarsen is to be tested further on patients who have relapsed after one of the courses of treatment with more familiar drugs.

A large field experiment has been carried out on prophylaxis with pentamidine, which has been tested in an area which had been visited three times at considerable intervals. No case of sleeping sickness occurred among approximately 3,000 people who had received pentamidine; even among those who had eluded treatment the incidence of the disease dropped to a very low level. Injection involves some slight discomfort but " the local population has been quick to recognise the great value of prophylactic pentamidine ". As there is some evidence that there is a transmission season for human sleeping sickness in Northern Nigeria it is thought that the routine use of pentamidine would be most effective if the drug were administered in February. It would then give protection through the late dry season and the early rains.

As the work on the ecology of *G. palpalis* in Northern Nigeria has been brought to an end, the field station became redundant and has been transferred to a suitable site near Ekpoma in the Benin province, *i.e.*, in an area of forest not savanna. The name of the spot is Ugbobiga [which will become as familiar as Shinyanga or Gadau, or so we may hope]. Standard prefabricated aluminium buildings, designed and constructed by the Western Regional Development Board of Nigeria, have been used. Within a few miles of this spot one may study *G. palpalis* and *longipalpis* and three members of the " *fusca* group " characteristic of high forest.

We note that in the northern part of the country, not very far from Kaduna, Nash and his colleagues are testing " obstructive clearing " as a measure for the control of *G. palpalis*. A pilot scheme is in hand to cost £9,850 over a 3-year period. It is thought that where a stream carries many creepers and thickets, one may encourage the growth of these plants so that they may obstruct the flight line of the tsetse up and down the stream. If the insect is compelled to forage in the adjacent savanna, it is likely that in the dry season the severe climate will kill it. A carefully thought out scheme with adequate controls is in operation. A long-term

experiment has also been commenced in order to study and measure erosion, and particularly to discover whether the type of clearing which is normally carried out against the water-side tsetse leads to increased erosion or to a growth of grass which tends to reduce the erosion and stabilize the bank of the stream.

The entomologists of this Organization compiled the West African sheet of the All-Africa Tsetse Map [see this *Bulletin*, 1953, v. 50, 1022; 1954, v. 51, 680] on which they may be congratulated. They also devoted much time and attention to the routine breeding of *G. palpalis*, their intention being to secure a regular supply of pupae from which clean flies could be produced at all seasons for transmission experiments and so forth.

The West African Institute for Trypanosomiasis Research is responsible for research in the laboratory and in the field on all aspects of human and animal trypanosomiasis; it also serves as a clearing house for information, and an advisory bureau. It has no responsibility for the actual conduct of control measures though it is frequently consulted. Funds are provided under the Colonial Welfare and Development Scheme and the four West African Governments. The Institute has its own statutory Managing Committee. *P. A. Buxton*

Glasgow, J. P. *Glossina palpalis fuscipes* **Newst. in Lake-Side and in Riverine Forest.** *Bull. Entom. Res.* 1954, Sept., v. 45, Pt. 3, 563–74, 3 figs.

The present author and before him Symes and Southby [this *Bulletin*, 1939, v. 36, 740] have carried out work on *G. palpalis* not far from Kisumu on the shores of Lake Victoria and along the banks of the Kuja River. Glasgow's experimental attempts at eradication by clearing a strip along the water's edge and by hand-catching will be remembered.

The present paper deals with other studies made at the same place. A Stevenson's screen was put up in what a meteorologist would accept as a suitable spot in a clearing some 200 yards from the edge of the Lake, and 50 ft. above it. Records of temperature show that there is little seasonal variation, the mean daily maximum calculated for each month over a period of two years always passing 80°F. and never reaching 90°F.: the mean daily minimum was almost always over 60°F. and seldom passed 65°F. Some rain occurred in almost every month, the total annual rainfall for 5 years ranging from 32–59 in. with a mean of 41 in. Several types of vegetation are described: in parts of the area there is a steep rise a little way back from the Lake to a plateau which is covered with thicket, partly evergreen, in which *G. palpalis* occurs.

Fly rounds were carried out at regular intervals—the number of non-teneral males taken per 10,000 yards, conventionally referred to as the Apparent Density, was taken as an index of population. This was continued weekly for a period of over 6 years in one block of vegetation and in other blocks for shorter periods. The Apparent Density shows long-term fluctuations which are not related to season and are not annual. Generally speaking the curves for several lake-side blocks fluctuate together. The block on the banks of the Kuja River fluctuated more violently than those on the lake side, and independently of the lake side.

In one block the true density of non-teneral male *palpalis* was ascertained by the method of release and recapture worked out and described by Jackson [*ibid.*, 1941, v. 38, 74]. The length of this block along the shore of the lake was 2,200 yd. and the width averaged about 100 yd., giving an area inhabited by *G. palpalis* of 45 acres. In this the mean

population of non-teneral males was estimated at 4,400 which gives a population per square mile of about 63,000. It was shown that an apparent density of 1 implies a population of 176 non-teneral males per square mile: *i.e.*, for identical populations of *G. palpalis* and *morsitans*, the apparent density would be much lower for the former than the latter species: there is therefore confirmation that *G. palpalis* is not very " available " to man in this area. In the block mentioned above it was found that the mean death rate was 26 per cent. per week and it appeared that this was not complicated by immigration or emigration: the mean length of life was therefore 27 days, these figures applying to the non-teneral males.

There is evidence that along the river *G. palpalis* is always more hungry than along the lake shore, which is shown by the percentage of teneral specimens, females and males, attacking man. *P. A. Buxton*

Gall, D. **The Chemoprophylaxis of Sleeping Sickness with the Diamidines.** *Ann. Trop. Med. & Parasit.* 1954, Sept., v. 48, No. 3, 242–58. [Numerous refs.]

The author is working in the Epidemiology Section of the West African Institute for Trypanosomiasis in Northern Nigeria. This paper is a review and appraisal of nearly 80 papers published since 1940 on the prophylaxis of African sleeping sickness with the diamidine series of drugs. After a historical survey of the use of the drugs for this purpose, the relevant results of work done with them in the various endemic areas are considered territory by territory. The recommended dosages and route of administration, the observed toxic effects of the compounds, and the reason for their failure as prophylactics in those treated with them are separately considered. The tactics and the strategy of prophylaxis campaigns are finally dealt with. As a result of his studies of this literature the author ends with the following conclusions:—

" 1. The first experimental work on the use of the diamidines as prophylactics against sleeping sickness was carried out in 1940 and 1941, and the first field trials in 1942. Thereafter propamidine and pentamidine were widely adopted as prophylactics, particularly in the Belgian and French African territories.

" 2. The drug of choice is now pentamidine, as diisethionate or dimethyl sulphonate, administered intramuscularly, in doses of 3–4 mgm. per kgm. of pentamidine base, at 6- to 12-monthly intervals.

" 3. The toxic effects are mostly immediate, mild and of small importance.

" 4. Prophylaxis campaigns have mainly been undertaken either where tsetse eradication has been impracticable for reasons of vegetation, lack of skilled or unskilled labour, or lack of funds, or for the protection of special communities, such as labour gangs at high risk.

" 5. A properly conducted campaign, of two or more injections according to the endemic conditions, is capable of reducing the incidence to less than 0·1 per cent. or even to zero in the protected population. The greater the proportion of the population protected and the smaller the migratory element, the greater are the chances of success.

" 6. Prophylaxis has proved successful where methods of mass survey and treatment, in the absence of tsetse control, have been only partly effective.

" 7. After regular prophylaxis has been discontinued, recrudescence or reintroduction of the infection is to be expected within a period of a few years, the period depending upon factors which include the extent of the

area protected, the size of the floating population, and the final incidence achieved.

"8. Failure of prophylaxis occurs in about 0·1 per cent., the majority of cases being due to early infections missed at the preliminary survey. Such cases do not usually show peripheral trypanosomes and have frequently progressed to central-nervous-system involvement."

A. R. D. Adams

BURNETT, G. F. **The Effect of Poison Bait Cattle on Populations of *Glossina morsitans* Westw. and *G. swynnertoni* Aust.** *Bull. Entom. Res.* 1954, Sept., v. 45, Pt. 3, 411–21, 2 figs.

The author has attempted to exterminate *Glossina morsitans* and *swynnertoni* in an area of bush of about half-a-mile square in the Northern Province of Tanganyika, by putting out considerable numbers of cattle sprayed with DDT; the intention is that in course of time all the *Glossina* would feed on the cattle and be killed by the insecticide. The number of cattle was equivalent to 100 per square mile, divided into small herds each moving over a separate part of the bush: they grazed in the bush 7 days a week. They were sprayed twice a week with a DDT emulsion. The area of bush was not completely isolated from other tsetse belts, though it was almost surrounded by barrier clearings. Within the area several varieties of ungulate game animals resided or passed through on their migrations: the cattle therefore competed with the game as a food supply for the tsetse.

Before the experiment started the catches of *G. morsitans* expressed in a standardized way were between 50 and 80; figures for *swynnertoni* were 13 and 30. Within a fortnight of the start of the experiment the figures for both insects fell to below 10, indeed the figure for *morsitans* was often below 1, but extermination was not achieved. This was attributed to immigration of fly across the barrier clearing. The experiment is interesting and promising. The fact that it was not quite successful [and see also the partial success reported by WHITESIDE, this *Bulletin*, 1949, v. 46, 922] is no reason for dropping the matter.

P. A. Buxton

TOBIE, Eleanor J. **The Effect of Puromycin on Six Species of *Trypanosoma* in Mice.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 852–9.

Puromycin (originally called Achromycin) has been reported to be active against *T. equiperdum* infections of laboratory animals [this *Bulletin*, 1953, v. 50, 690]. The structure and properties of this antibiotic from a species of *Actinomyces* have also been described. The present author has investigated the activity of the substance against infections in mice with *T. equiperdum*, *T. equinum*, *T. evansi*, *T. gambiense*, *T. rhodesiense* and *T. congolense*. Female white mice of weight 20 gm. were used and infected with 10,000 trypanosomes intraperitoneally. The drug was given by the same route in 0·2 ml. saline. The course of the infection was followed by microscopic examination of smears of tail blood. When the mice had survived treatment 30 days or more and blood smears were negative, sub-inoculation to fresh mice was carried out and the blood of the fresh hosts examined over the period of a month, and cryptic infections were sometimes found after this period.

In early tests 7 doses of 20 mgm./kgm. were given, starting 4 hours after inoculation, and the results indicated that all the infections except that due

to *T. congolense* failed to develop. In other tests a total of three times this amount (420 mgm./kgm) was administered. When given 4 days prior to inoculation Puromycin showed no prophylactic effect. Acute infection was suppressed by it except in the case of *T. congolense*, and some cures resulted. The least susceptible species were *T. rhodesiense* and *T. gambiense*. *J. D. Fulton*

Tobie, Eleanor J. & von Brand, T. **Further Studies on Arsenic Resistance in** *Trypanosoma gambiense*. *Trans. Roy. Soc. Trop. Med. & Hyg.* 1954, Sept., v. 48, No. 5, 426–30, 4 figs.

The authors have previously described the development of resistance in the blood-stream form of *T. gambiense* to reduced tryparsamide [this *Bulletin*, 1953, v. 50, 916]. The work has been continued in order to study the duration of resistance and the hypersensitivity displayed to nitrofurane compounds. The results of treatment of the resistant strain with repeated doses of sodium arsenite have also been further investigated. For this purpose a normal strain of *T. gambiense* and a strain resistant to reduced tryparsamide strain were exposed over a period of 13 months on more than 40 occasions to dilute solutions of sodium arsenite. Whereas the strain resistant to reduced tryparsamide was less resistant than the normal strain after this treatment as judged by infectivity tests, in respiratory inhibition tests the reverse was the case. Exposure to arsenite did not alter the effect of reduced tryparsamide or of a nitrofurane on respiration. It was found that after 21 months the resistance to reduced tryparsamide had decreased in absence of drug, but the hypersensitivity displayed by the resistant strain to a nitrofurane derivative was unaltered. *J. D. Fulton*

Peel, E. & Chardome, M. Sur les infections à trypanosomes, transmises par *Glossina brevipalpis* dans la région du Mosso-sud (Urundi). [**Trypanosomes transmitted by** *Glossina brevipalpis* **in South Mossi, Urundi**] *Ann. Soc. Belge de Méd. Trop.* 1954, June 30, v. 34, No. 3, 259–68, 11 figs. on 2 pls.

Peel, E. & Chardome, M. Observations sur les élevages de *Glossina brevipalpis* Newst., au laboratoire. [**Breeding of** *G. brevipalpis* **in the Laboratory**] *Ibid.*, 269–75.

Peel, E. & Chardome, M. *Trypanosoma suis*—Ochmann 1905—trypanosome monomorphe pathogène de mammifères, évoluant dans les glandes salivaires de *Glossina brevipalpis*. [**Development of** *T. suis* **in** *G. brevipalpis*] Newst., Mosso (Urundi). *Ibid.*, 277–95, 8 pls. [13 refs.]

Peel, E. & Chardome, M. Étude expérimentale d'une souche considérée comme *T. congolense* Broden 1904 et transmise par *Glossina brevipalpis* du Mosso (Urundi). [**Study of a Trypanosome believed to be** *T. congolense* **transmitted by** *G. brevipalpis*] *Ibid.*, 297–302, 16 figs. on pl.

Peel, E. & Chardome, M. Étude expérimentale d'une souche appelée *T. congolense* var. *urundiense* transmise par *Glossina brevipalpis* du Mosso (Urundi). [**Study of a Strain believed to be** *T. congolense* **var.** *urundiense* **transmitted by** *G. brevipalpis*] *Ibid.*, 303–9, 4 pls.

Chardome, M. & Peel, E. Étude expérimentale d'une souche appelée *T. congolense* var. *berghei* transmise par *Glossina brevipalpis* du Mosso (Urundi). [**Study of a Strain believed to be** *T. congolense* **var.** *berghei* **transmitted by** *G. brevipalpis*] *Ibid.*, 311–20, 4 pls.

Peel, E. & Chardome, M. Étude expérimentale d'une souche appelée *T. congolense* var. *mossoense* transmise par *G. brevipalpis* du Mosso (Urundi). [**Study of a Strain believed to be** *T. congolense* **var.** *mossoense* **transmitted by** *G. brevipalpis*] *Ibid.*, 321–43, 5 pls. [13 refs.]

Peel, E. & Chardome, M. Étude expérimentale de souches de *T. simiae* Bruce 1912, transmises par *Glossina brevipalpis* du Mosso (Urundi). [**Study of Strains of** *T. brucei* **transmitted by** *G. brevipalpis*] *Ibid.*, 345–59, 4 pls. [19 refs.]

Peel, E. & Chardome, M. Infections multiples à trypanosomes transmises aux mammifères par *Glossina brevipalpis* du Mosso. (Urundi). [**Multiple Trypanosome Infections transmitted to Mammals by** *G. brevipalpis*] *Ibid.*, 361–6, 10 figs. on pl.

Peel, E. & Chardome, M. Recherches sur l'éventualité d'une trypanosomiase héréditaire chez les animaux. [**Study of the Eventuality of a Hereditary Trypanosome in Animals**] *Ibid.*, 367–9.

This number of the *Annales* is devoted to this series of studies on *G. brevipalpis* in Mosso, Urundi, and experimental transmission of animal trypanosomes by it.

Pellegrino, J. A doença de Chagas em Minas Gerais. Esbôço crítico dos trabalhos publicados até 1951. [**Chagas's Disease in Minas Gerais. A Critical Study of the Papers published up to 1951**] *Mem. Inst. Oswaldo Cruz.* 1953, Dec., v. 51, 611–68. [Numerous refs.] English summary.

Barth, R. Estudos anatômicos e histológicos sôbre a subfamília Triatominae (Heteroptera, Reduviidae). III. parte: Pasquisas sôbre o mecanismo da picada dos Triatominae. [**Anatomical and Histological Studies on the Subfamily Triatominae. Part III. Studies on the Biting Mechanism**] *Mem. Inst. Oswaldo Cruz.* 1953, Dec., v. 51, 11–68, 22 figs. [German version 69–94. (26 refs.)]

Pellegrino, J. & de Rezende, C. L. A doença de Chagas na Infância. [**Chagas's Disease in Infancy**] *Mem. Inst. Oswaldo Cruz.* 1953, Dec., v. 51, 545–610, 23 figs. [Numerous refs.]

A full account and review of the literature.

LEISHMANIASIS

In this section abstracts are arranged as far as possible in the following order:—visceral, cutaneous, muco-cutaneous.

Vives Sabater, J. Especies de "Phlebotomus" halladas en Barcelona y sus alrededores. [**Species of** *Phlebotomus* **found in Barcelona and its Neighbourhood**] *Rev. Sanidad e Hig. Pública.* Madrid. 1954, May–June, v. 28, Nos. 5/6, 301–41, 17 figs. (15 on 4 pls.) [Numerous refs.]

Much of the paper is general and introductory. The valuable part deals with the author's own work in the region of Barcelona, and his description of localities. His total captures appear to have been about 200 specimens,

among which *P. perniciosus* and *minutus* were common, *ariasis* and *sergenti* rare. *P. papatasi* was not met with. [It is remarkable that 40 pages of print should be given to so small an investigation.] *P. A. Buxton*

FEVERS OF THE TYPHUS GROUP

In this section abstracts are arranged as far as possible in the following order:—general; louse-borne typhus, flea-borne typhus, mite-borne typhus; rickettsialpox; tick-borne typhus; Q fever, other rickettsial diseases.

Hurlbut, H. S., Peffly, R. L. & Salah, A. A., with the technical assistance of E. W. Spangler, E. Nagib & M. M. Armanious. **DDT Resistance in Egyptian Body Lice.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 922–9.

DDT-resistant lice were encountered in Korea in 1950–51 [Hurlbut *et al.*, this *Bulletin*, 1952, v. 49, 565] and similar resistance was reported for a colony obtained from Egypt in 1952 [Busvine, *ibid.*, 1953, v. 50, 657].

In this paper the situation in Egypt is examined more closely, by laboratory tests on lice from different parts of the country and by field trials. Resistance was confirmed in lice taken from people in villages near Cairo. The laboratory tests suggested that the degree was less than that in Korea.

10 per cent. DDT dust killed 89 per cent. Egyptian lice
,, ,, ,, ,, ,, ,, 48 per cent. Korean lice (data of Hurlbut, 1952)
0·25 ,, ,, ,, ,, ,, 100 per cent. susceptible lice (laboratory colony, U.S.A.)

In other tests, 1st stage lice were placed on cloth that had been impregnated by acetone solutions of DDT, and attempts were made to rear them to adults.

46 per cent. Egyptian lice became adult on cloth dipped in 1:5,000 DDT
No ,, ,, ,, ,, ,, ,, ,, ,, 1:1,000 DDT
35 per cent. Korean ,, ,, ,, ,, ,, ,, ,, 1:1,000 DDT (Hurlbut, 1952)

Some lice were obtained from remote areas (Cyrenaica and Sinai) where DDT was unlikely to have been used. These were found to be much more susceptible, since 90 to 100 per cent. of them died in the 1st stage on cloth dipped in 1:10,000 DDT.

In two field trials, villagers were dusted with 10 per cent. DDT or 0·5 per cent. *gamma* BHC, but by dust guns, without removing the clothing. The DDT was observed to produce some control, though rather less than that obtained in 1945. The 0·5 per cent. *gamma* BHC gave even less satisfactory results [contrary to the findings of Shawarby (*Bull. Entom. Res.*, in press)]. *J. R. Busvine*

Stewart, W. H. & Hines, Virginia D. **Murine Typhus Fever in South-West Georgia, January 1945–January 1953.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 883–9, 4 figs. [12 refs.]

In an area of south-west Georgia with a population of 82,787 there were 452 cases (5·4 per 1,000) of murine typhus from January 1945 till January

1953. The incidence in the rural population was 7·0 per 1,000 and in the urban population it was only 3·3 per 1,000. Farmers with their wives and children contributed 70 per cent. of all the cases in the area.

In the rural area there were far more cases in the months of May to August than in the other months of the year; in the urban regions the cases were fairly evenly distributed throughout the year. The incidence among the coloured people was only 1·1 as compared with 8·6 among the white. There were few cases among children under the age of 5 years; after that age the incidence rose rapidly, reaching its highest peak between the ages of 40 to 50. More males than females were attacked, the respective rates being 6·7 and 4·2. The average Weil-Felix titre was highest about the end of the first week, when it was over 1 in 400. It declined to about 1 in 100 by the 10th week. The complement-fixation titre reached its peak during the 2nd week when it averaged about 1 in 40; it remained high for 50 to 60 weeks and fell gradually during the following 6 months. [The illustrative graph shows that the titre had fallen to 1 in 10 by the 50th week and to 1 in 6 by the 100th week.]

In patients treated by aureomycin the Weil-Felix reaction was hardly affected except for a slight delay in the response, but the complement-fixation titre was consistently lower than in the untreated.

John W. D. Megaw

Audy, J. R. **Malaysian Parasites III. A Summary Review of Collections of Trombiculid Mites in the Asiatic-Pacific Area.** *Studies from Inst. Med. Res. Federation of Malaya.* 1953, No. 26, 29–44. [Numerous refs.]

The outbreaks of scrub typhus, among army personnel in the Asiatic-Pacific area during World War II, gave a new impetus to the study of Trombiculid mites, which does not seem to have diminished even now. During these years, extensive and intensive collections of chigger mites have been made by various authors. The author of the present paper has brought together and summarized in tabular form all the available data, widely dispersed in literature, about 100 collections of Trombiculid mites from the Asiatic-Pacific region. The number of different hosts examined, and the relative abundance of the various Trombiculid genera in the different geographical areas, are recorded.

The author points out that very often the available data may not give an accurate idea of mite incidence in a particular area; for example, the number and species collected may depend on the topography of the land (deforested and settled areas as opposed to scrub jungle), on bias in collecting host species and on seasonal changes in the collecting area. As an illustration of the last point, the author remarks on the collections made in the same patch of scrub in the Imphal area, a few months apart in 1945–1946, which gave completely different pictures of mite incidence.

M. G. R. Varma

Traub, R. & Audy, J. R. **Malaysian Parasites IV. Species of *Trombicula* (Acarina Trombiculidae) from Borneo.** *Studies from Inst. Med. Res. Federation of Malaya.* 1953, No. 26, 45–76, 94 figs. & 1 map.

This paper deals with collections made in North Borneo in 1950, 1951 and 1952. Larvae of 3 new species of *Trombicula*, *T. flagellifera*, *T. tuhana*, *T. vorca* and 5 new species of the subgenus *Leptotrombidium*, *T.* (*L.*)

baluensis, *T.* (*L.*) *pipellae*, *T.* (*L.*) *pilalta*, *T.* (*L.*) *tarsala* and *T.* (*L.*) *micula*, are described. The standard measurements, ratios and diagnostic characters of these 8 new species and *T.* (*L.*) *deliensis* and *T.* (*L.*) *akamushi*, the 2 known vectors of scrub typhus, are compared in a table.

A map of the collecting areas in N. Borneo and some excellent drawings of the scuta, legs and palps of the larval mites are also included in the paper. *M. G. R. Varma*

Traub, R. & Audy, J. R. **Malaysian Parasites V. Species of *Euschöngastia* sensu lato (Acarina Trombiculidae) from Borneo.** *Studies from Inst. Med. Res. Federation of Malaya.* 1953, No. 26, 77–88, 53 figs.

The authors point out that the rickettsiae of scrub typhus and murine typhus have been isolated from larval mites of the genus *Euschöngastia* [this *Bulletin*, 1950, v. 47, 1077; 1951, v. 48, 140]. These mites, however, are normally parasites of rodents and by playing a part in the transmission of infection among their animal hosts may be of considerable indirect medical importance.

In this paper, 6 new species of larval *Euschöngastia* from Borneo are described and illustrated. These are *E. indicella*, *E. roluis*, *E. ocellifera*, *E. daria*, *E. calunosa* and *E. asonluca*. Their standard measurements are tabulated and compared. The last 2 species are placed in the subgenus *Walchiella*. *M. G. R. Varma*

Traub, R. & Evans, T. M. **Malaysian Parasites VI. Indo-Malaysian Chiggers of the Subgenus *Schöngastiella* (Acarina Trombiculidae).** *Studies from Inst. Med. Res. Federation of Malaya.* 1953, No. 26, 89–107, 76 figs. [10 refs.]

During and since World War II, a very large number of chigger mites have been collected from Malaya, Burma and India, in connexion with studies on scrub typhus. Larvae of 7 new species of the subgenus *Schöngastiella* (genus *Gahrliepia*) from these regions, are described and illustrated in the present paper. They are *liota*, *erula*, *helata*, *birella*, *arona*, *kalrata* and *gammonsi*. Comments and notes on 3 more species *ligula*, *punctata* and *hipposideros* are also included. The commonest species of the subgenus in Assam and North Burma was *G.* (*S.*) *ligula*. This species was a characteristic parasite of *Rattus*, in scrub terrain, whereas *G.* (*S.*) *punctata* seemed to favour shrews. The new species *arona* and *birella* from Malaya were exceptional in having an anal plate. *G.* (*S.*) *kalrata* was collected from a mouse in Kashmir (India).

In conclusion, the authors remark that the subgenus *Schöngastiella* is remarkably uniform in its taxonomic characters. Compared to the infestation of host animals by larvae of chiggers like *Trombicula deliensis*, infestations with larvae of some of the new species of *Schöngasticlla*, seem to be rather low. *M. G. R. Varma*

Audy, J. R. **Malaysian Parasites IX. Notes on the Taxonomy of Trombiculid Mites with Description of a New Subgenus.** *Studies from Inst. Med. Res. Federation of Malaya.* 1953, No. 26, 123–70, 3 figs. [54 refs.]

This paper on the taxonomy of Trombiculid mites is intended to supplement the monographs of Womersley [this *Bulletin*, 1952, v. 49, 942] and Wharton and Fuller [*ibid.*, 1953, v. 50, 983].

Since only the larvae of these mites are parasitic and hence important from a medical point of view, classification of the family has been based mainly on larval characters. Needless to say, in such a system where post-larval stages are not considered, the true affinities between different larval species have been lost sight of. The author points out that much of the confusion existing in the taxonomy of Trombiculid larvae is the result of (1) raising a genus or subgenus on a useful key character such as the presence of teeth on the chelicerae, which makes classifications artificial by accumulating species which are not congeneric, (2) by raising a monotypic genus when the genotype happens to have an extremely well developed character which is not represented in other species discovered later on, and (3) by taking recurrent polyphyletic characters which appear independently in various unrelated groups, as the basis of classification; examples of this are variations in the extension of the scutum to exclude or include setae, scutal submergence, the division of femora of legs II and III and the modification of setae.

The present paper is an attempt to assess the value of various diagnostic characters and bring some order into the classification. The importance of rearing experiments to obtain nymphs and adults of the Trombiculidae and the value of post-larval stages in the classification of these mites, have been recognized since the pioneer work of Womersley. In the present paper, the author has tried to do this for about 130 species of larvae and 70 species of nymphs from Malaysia.

It is suggested that the various body setae and scutal setae may have more taxonomic importance than is usually supposed. The classification of Trombiculid mites, according to the author, will ultimately be based on post-larval as well as larval characters. In view of such a system, revised diagnoses of many genera and subgenera of Old World chiggers have become necessary and certain species groups like the *Euschöngastia indica*, *E. lacunosa* and *Doloisia oculicola* groups may have to be raised to the status of subgenera. Some species and species groups require further study and these have been left either unallocated, or provisionally placed under genera and subgenera until such time as when rearing experiments will reveal their true affinities.

The subfamily *Trombiculinae* is divided into 2 generic groups related to *Trombicula* and *Euschöngastia* respectively. The subgenus *Trombicula* is based on the larval and nymphal characters of a new bat chigger which appears to be congeneric with *T. minor*. The *lacunosa* group of the genus *Euschöngastia* may possibly be identified with *Walchiella*, while the *indica* group is shown to have affinities with the genus *Doloisia* sensu lato. A new subgenus *Helenicula* is placed in *Euschöngastia*. *M. G. R. Varma*

Sasa, M. **Description of Nymphs and Adults of Japanese Trombiculid Mites reared in the Laboratory. (Studies on Tsutsugamushi, Part 54.)** *Japanese J. Exper. Med.* 1953, Oct., v. 23, No. 5, 407–50, 25 pls. [20 refs.]

Sigalas, R. & Lamontellerie, M. Problèmes posés par l'épidémiologie de la fièvre boutonneuse. [**Problems connected with the Epidemiology of Boutonneuse Fever**] *J. Méd. de Bordeaux.* 1954, Oct., v. 131, No. 10, 963–8. [25 refs.]

From a study of the epidemiological features of boutonneuse fever the authors have formed the opinion that *Rhipicephalus sanguineus* plays only

a minor part in the transmission of infection to man and that the chief rôle of this tick is that of a reservoir of infection. They think that human infection is usually transmitted from dogs which act as healthy carriers, and that the vector is an actively mobile arthropod having its habitat in the affected area; the arthropods suspected are Trombidiidae, fleas, lice, *Phlebotomus*, mosquitoes, *Culicoides* or Reduviidae. Infection by the conjunctival route is considered possible, the mechanism being contact with fingers which have handled infected ticks. *John W. D. Megaw*

Badiali, C., Venturi, R. & Zoli, A. Ricerche sulla febbre " Q " in Emilia-Romagna. Nota V.—Ancora sulla intradermoreazione per febbre " Q " nell'uomo. [**Q Fever Research in Emilia-Romagna. Fresh Studies of the Intradermal Reaction for Q Fever in Man**] *Riv. Italiana d'Igiene*. 1954, July–Aug., v. 14, Nos. 7/8, 416–23. English summary (9 lines).

In their previous studies on the epidemiology of Q fever [see this *Bulletin*, 1953, v. 50, 1036] two of the authors preferred the complement-fixation reaction (CFR) to the intradermal reaction (IDR) for the retrospective diagnosis of Q fever. They regarded the former as more sensitive, more specific and more practicable; it was also free from the risk of severe local and general reactions which sometimes occurred when the test was made on recently infected persons. Still another objection was the possibility that the antigen injected in carrying out the test might cause the production of antibodies and so cause false positive reactions in later tests.

The authors now describe simultaneous IDR and CFR tests of 35 persons who had not been exposed to any known risk of Q fever infection. In all of these the CFR was negative but the IDR was strongly positive (+ + +) in 2, moderately positive (+ +) in 3 and weakly positive (+) in 3; it was doubtfully positive (±) in 7 and negative in 20. In CFR tests of the same persons 10–12 days later one gave a positive reaction at 1 in 16, but in still later tests 25–30 days after the original tests this person gave a negative CFR and 2 other persons reacted feebly at 1 in 4.

In a similar series of tests of 7 persons, who were believed to have had Q fever, 6 gave positive reactions at titres of 1 in 4 to 1 in 32 and the results of the IDR were consistent with those of the CFR. In CFR tests 25–30 days later 4 of the 6 positive reactors had titres twice to four times higher than in the original tests; in the other 2 the titres remained the same. It appears, therefore, that the antigen injected in carrying out the IDR has little or no tendency to give rise to the production of complement-fixing antibodies when none already exist, but has a distinct tendency in some cases to increase the titre of antibodies which already exist. A more important finding is the occurrence of an appreciable proportion of false positive reactions in healthy persons who have never had Q fever.

John W. D. Megaw

Anderson, R. K. & Kalra, S. L. **Q Fever Studies in India: a Case of Human Q Fever.** *Indian J. Med. Res.* 1954, July, v. 42, No. 3, 307–14, 1 fig.

" 1. A case of Q fever was diagnosed from rising antibody titre in successive blood specimens.

" 2. From the serological and other evidence obtained it is presumed that the experimental animals and the embryonated eggs were infected with *R. burneti*.

" 3. A probable case of Q fever with pneumonitis had occurred previously in the same family."

KALRA, S. L. & TANEJA, B. L. **Q Fever in India: a Serological Survey.** *Indian J. Med. Res.* 1954, July, v. 42, No. 3, 315–18.

The authors describe the diagnosis of Q fever infection in 3 cows from a dairy farm in Poona in December 1952. The sera of the animals gave complement-fixation titres against the Nine-mile strain of Q fever antigen of 1 in 512, 1 in 128 and 1 in 128, respectively. These cows and another belonging to the same herd were found to have been suffering from an undiagnosed fever. The febrile and serological reactions of some of the guineapigs that were inoculated with the milk of the cows were suggestive of Q fever infection. In January 1953 the case of human infection reported above was diagnosed, and later three other cases were diagnosed at the Military Hospital, Poona. The above seem to be the first confirmed cases of the disease among persons and cattle in India.

A serological survey of the disease was made in various parts of India in 1953. Complement-fixation tests with the Nine-mile strain of Q fever antigen were made on human sera with the following results. The percentage of positive reactions at titres of 1 in 8 to 1 in 128 are shown for each area; the figures in brackets refer to the number of sera examined: Mysore 16·6 (144); Madras 11·3 (97); Jammu 10·5 (228); Amritsar 7·9 (264); Jaipur 5·4 (129); Agra 5·0 (80); Shillong 4·1 (73); Calcutta 3·6 (109); Poona 2·3 (172); Delhi 0 (85).

Among different animals from Bihar, Lucknow, Hissar, Kasauli, Muktesmar and Poona the following percentages of positive reactions occurred, the localities of origin of each species are not stated: Sheep 11·5 (287); buffaloes 9·8 (143); cows 6·5 (291); goats 3·3 (90).

In the course of the survey it was found that Wassermann-positive human (WRP) sera gave a slightly, though not significantly, higher proportion of positive reactions than occurred among Wassermann-negative sera; this observation was followed up by making comparative complement-fixation tests with the Henzerling strain of antigen from the Rocky Mountain Laboratory and the Nine-mile strain of the Lederle Laboratories which was already in use. Among 110 WRP sera only 2 reacted with the Nine-mile strain of antigen against 13 which reacted with the Henzerling strain. In another experiment with Henzerling antigen 52 sera with strongly positive Wassermann reactions (titre 40 or over) yielded 27 positive reactions for Q fever whereas 36 sera with weakly positive Wassermann reactions (titre 20 or under) yielded only 4 Q fever reactions.

It was concluded that non-specific reactions for Q fever occurred in Wassermann-positive sera with Henzerling antigen but not with Nine-mile antigen. *John W. D. Megaw*

FASTIER, L. B. **A Survey of 1,300 Human Sera for Q Fever Antibodies.** *New Zealand Med. J.* 1954, Aug., v. 53, No. 296, 365–7.

Among 1,300 sera from persons in various parts of New Zealand since 1952 only 4 gave complement-fixation reactions for Q fever. The titres ranged from 1 in 16 to 1 in 32 and 3 were from persons who had immigrated to New Zealand from Bulgaria, Russia and Switzerland, respectively, within the previous 3 years. The fourth positive serum was from a mental-hospital patient whose parents were Greek and Austrian but there was no evidence to show that he was not a native of New Zealand

The sources of the sera were as follows: 45 were from patients suffering from atypical pneumonia; 44 were from workers in an abattoir; 1,020 were from persons undergoing the Wassermann test; and 190 were from blood donors.

The author seems fully justified in concluding that while Q fever cannot be dogmatically stated to be absent from the areas examined its incidence must be extremely low.

The only record of the occurrence of Q fever in New Zealand relates to infection found in a goat freshly imported from an infected farm in England and still under observation in a quarantine station [see this *Bulletin*, 1954, v. 51, 46]. *John W. D. Megaw*

Varela, G. & Schnaas, G. Investigación de la fiebre " Q " bovina empleando leche para la aglutinación en capilares. [**Studies of Q Fever by Means of Agglutination Tests of Milk**] *Rev. Inst. Salubridad y Enfermedades Trop.* Mexico. 1954, Mar., v. 14, No. 1, 43–6, 1 fig.

The English summary appended to the paper is as follows:—

" Agglutination tests with *Coxiella burneti* antigen were performed with samples of milk from cows and women. Thirty percent of 1,000 samples of cows' milk and 15% of 100 samples of human milk gave positive reactions.

" The use of milk offers an especially easy method for the epidemiological investigation of ' Q ' fever in lactating women and cows."

Varela, G., Fournier, R. & Mooser, H. Presencia de *Rickettsia quintana* en piojos *Pediculus humanus* de la ciudad de México. Inoculación experimental. [**Presence of *Rickettsia quintana* in *Pediculus humanus* in the City of Mexico and Inoculation Experiments in Volunteers**] *Rev. Inst. Salubridad y Enfermedades Trop.* Mexico. 1954, Mar., v. 14, No. 1, 39–42, 1 chart.

The English summary appended to the paper is as follows:—

" *Pediculus humanus* from Mexico, D.F. are infected with *Rickettsia quintana* of Trench Fever. Experimental inoculation of their faeces into two human volunteers produced a febrile illness characteristic of Trench Fever. Healthy lice feeding upon these patients become infected with *R. quintana.*

" This is the first report of the presence of *Rickettsia quintana* in the Americas."

YELLOW FEVER

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, transmission, pathology, diagnosis, clinical findings, treatment, control.

World Health Organization. **African Seminar on Yellow Fever, Kampala, Uganda, 7–12 September 1953.** Held under the sponsorship of the WHO Regional Office for Africa, Brazzaville, French Equatorial Africa. pp. xv + 271 mimeographed. 1954. Brazzaville: WHO Regional Office for Africa.

The seminar, of which this document records the proceedings, was attended by the representatives of 15 African territories, by members of

the WHO Expert Advisory Panel on Yellow Fever, and by a number of consultants, observers and WHO staff members. The document contains the text of the papers presented at the seminar and a summary of the discussions which took place; it also contains an account of visits paid by participants in the seminar to the Virus Institute at Entebbe and to various forest areas in Uganda, as well as the report of an intergovernmental conference, in which only medical representatives of African territories took part. The subject matter is arranged in six sections: I. Yellow fever in Africa; II. Laboratory diagnosis of yellow fever; III. Yellow fever control measures in the Americas; IV. Vaccination against yellow fever; V. Visits and demonstrations; VI. Conference on the delineation of the southernmost limit of yellow fever infection in Africa.

In Section I, Mahaffy outlines the general problem of yellow fever in Africa and finds a practical answer to that problem in the elimination of *Aëdes aegypti* from all urban communities in the endemic area and in the mass vaccination of human populations in rural endemic areas. De Meillon gives an account of the distribution, adult habits and breeding places of the proved and potential vectors of yellow fever in South Africa. Chabaud and Ovazza list the known and possible vectors met with in Ethiopia. Lumsden, in explaining the yellow fever vector situation with reference to Entebbe airport, adduces evidence to show that *Taeniorhynchus*, three species of which are by far the commonest man-biting mosquitoes in Entebbe, is incapable of transmitting yellow fever virus in the field. Cambournac, Freedman and Prates report, respectively, on the yellow fever situation in Angola and in the Islands of São Tomé and Principe, in Bechuanaland, and in Mozambique. Among points discussed in this section are: the need of standard maps for the delineation of yellow fever areas and the distribution of vectors; and the difference between the habits of known and possible mosquito vectors in different parts of Africa.

In Section II, Macnamara shows that, as a diagnostic procedure for yellow fever in West Africa, isolation of the virus circulating in the blood can be a sufficiently reliable alternative to the performance of serological tests, provided that attempts at isolation are made early in the disease or, if the case is severe, during the first six or more days of illness. By making more rapid diagnosis possible, isolation of the virus enables control measures to be instituted with a minimum of delay. Courtois raises the question of the specificity of the histological lesions produced in the liver by the virus of yellow fever and asks whether, in view of the different results obtained on the same liver specimen by different laboratories, agreed criteria should not be satisfied before a positive diagnosis is definitely made. Discussions on the question raised by Courtois reveal considerable divergence of opinion on the degree of reliance to be placed on the result of histological examination alone, and various suggestions are made as to means whereby confirmatory evidence of yellow fever infection may be established.

In Section III, Antunes gives a detailed account of yellow fever control in Brazil, where the urban disease has been successfully dealt with by measures taken to eradicate *Aëdes aegypti*, namely, by kerosene from 1931 to 1947 and thereafter by DDT, and where jungle yellow fever has been combated by large-scale immunization with 17D virus vaccine since 1937. Boshell and his collaborators record the results of their epidemiological studies on the 1948–53 wave of jungle yellow fever, which passed from Panama to Costa Rica and thence to Nicaragua; in its passage the yellow fever virus followed the path of the tropical rain forest and the distribution of *Haemagogus spegazzinii falco*. Soper restates his view that yellow fever

transmitted by *Aëdes aegypti* is potentially the most important factor in the international and interregional spread of the disease. Gast-Galvis describes the work of the Carlos Finlay Institute in Bogotá which in 1934 initiated the campaign for the control of yellow fever in Colombia. Current epidemiology in that country concerns only forest or rural areas, where the disease is generally endemic, with small epidemic outbreaks; in all areas where positive cases have been found, the presence of *Haemagogus spegazzinii falco* has been confirmed. Discussions on Boshell's paper suggest the possibility that the last previous epizootic of yellow fever in Central America was about 30 years ago. Observations made in that paper suggest that the rôle of *Phlebotomus* as a possible vector of yellow fever should again be investigated.

In Section IV the incidence and aetiology of the reactions, particularly those of the meningo-encephalitic type, which have been observed to follow vaccination against yellow fever, are dealt with in papers by Durieux, by Laigret, and by Stuart. In one paper by the last-named author are included the main particulars of 5 cases of meningo-encephalitis reported by Lépine as having followed immunization in 1952–53 with 17D virus vaccine at the Pasteur Institute, Paris—the first reported occurrence of this nature since 1941, when the manufacture of 17D vaccine was standardized and the " seed-lot " system adopted. Duration of the immunity induced after vaccination against yellow fever is considered in papers by Courtois and by Stuart; in the first of these papers immunity is shown to have been still present at least 9 years after inoculation with 17D virus vaccine. Papers on the problem of mass vaccination against yellow fever and on the combined use of the viruses of yellow fever and vaccinia by the scratch method for immunization against yellow fever and smallpox are contributed by Stuart. Discussions in this section turn largely on the aetiology of meningo-encephalitis following yellow fever vaccination, and many interesting hypotheses are advanced. The isolation by Macnamara of the vaccine virus from the brains of 4 persons, who died of encephalitis after vaccination by the Dakar method between 14 January and 7 February 1952 in Nigeria, however, confirms the belief that the use of the French neurotropic strain in man can, in certain cases, be considered as a direct cause of the condition. As regards the duration of immunity induced by vaccination, Durieux states that, in his experience, whether the Laigret or the Dakar vaccine had been used, the percentage of immunity among persons vaccinated 9 years previously exceeded 90.

In Section V details are given of a visit by participants in the seminar to the Virus Institute, Entebbe, and of an excursion to the Institute's station in the Zika forest area and thence *via* the wooded country around Mpigi to the forest area near Bujuko, in all three of which areas the incidence of immunity to yellow fever among monkeys is unusually high.

In Section VI the intergovernmental conference provides a report, which indicates the southernmost limits in Africa of the area wherein protective antibodies against yellow fever virus were revealed in human sera by the 1952–53 survey sponsored by WHO. The report also notes the inapplicability of the definition of " yellow fever endemic zone " in the International Sanitary Regulations to those areas in southern Africa in which information on entomological populations or on the potential animal reservoirs of yellow fever is insufficient or lacking, and represents the desirability of collaboration between WHO and the governments concerned in undertaking the field studies necessary to elucidate the yellow fever epidemiology in such areas.

G. Stuart

Bull. World Health Organization. Geneva. 1954, v. 11, No. 3, 315–507. **Yellow Fever in Africa.** [Symposium.]

This number, devoted solely to the subject of yellow fever in Africa, contains (a) a selection of the communications presented at the WHO-sponsored seminar on yellow fever held at Kampala, Uganda, in September 1953 and (b) the texts of 3 further papers on that subject contributed at a somewhat later date. The communications under (a) have already appeared in a mimeographed document entitled " African Seminar on Yellow Fever " and been reviewed in this *Bulletin* [above].

The papers under (b) may be summarized as follows. Bonnel and Deutschman assemble, with respect to each of the African territories concerned, all available data on the occurrence, within recent years, of yellow fever cases and deaths among the human populations, on the positive mouse protection tests given both by human and by animal sera, and on the results of entomological surveys, and are thus able to sum up present-day knowledge of the yellow fever situation in Africa. Further immunity surveys in man and animals and further studies on animal reservoirs and insect vectors of the virus are, however, required before the full extent of the geographical penetration of the virus in that continent can be estimated. The distribution of human cases of yellow fever reported in Africa during recent years makes it clear that such cases have been rarely of the urban type transmitted by *Aëdes aegypti*, but mostly of the sylvan, rural type transmitted by non-domestic mosquitoes such as *Aëdes simpsoni* and *Aëdes africanus*, species which in Uganda have been proved to be responsible for the transmission of the virus to the monkey and to man.

Lumsden examines the results of the pre-1951 and the 1951 surveys of the distribution of human immunity to yellow fever in Kenya and emphasizes the difficulty of interpreting the significance of positive protection tests in a territory wherein vaccination against that disease has been widely practised. In his view there is a distinct possibility that a considerable proportion of the immunes found in Kenya may be those who have had previous yellow fever vaccination. He believes the natural introduction of yellow fever virus into man to be, at the most, a rare occurrence in Kenya, where only two cases of yellow fever in man have ever been recognized. On the other hand, virus transmission continues among wild mammals, particularly among species of galago, *Galago crassicaudatus* and *G. senegalensis*, but it has been observed that, in areas where galagos appear to be the main wild mammal involved in the yellow fever cycle, infection in man is rare.

Breteau recalls the severe epidemic of yellow fever in French West Africa during 1927, when in the whole territory there were 190 cases and 135 deaths—94 cases and 66 deaths in the Cape Verde Peninsula alone—and furnishes details of the preventive measures adopted and of the results obtained by systematic vaccination of the population and control of *Aëdes aegypti* both in the territory as a whole and in the peninsular part of that territory. In the Peninsula, protection tests carried out on sera collected in 1938 from children born since 1928 showed that the infection had completely disappeared after the 1927 epidemic, and yellow fever is no longer held to be endemic—since 1927 no human case has been reported, no animal reservoir of virus has been discovered, and there has been uninterrupted and highly effective control of *Aëdes aegypti*. The immunity conferred on the population by vaccination and revaccination within 14 years is maintained at a very high level. In the rest of the territory, where on a population of 17,500,000 there had been 38,687,549 vaccinations

performed by the end of 1952, and where an intensive campaign against *Aëdes aegypti* has been waged since 1927, yellow fever has been held in check; the disease has become essentially rural, such cases as have occurred having been rare, isolated and widely scattered. There would appear to be little danger of recrudescence in spite of an animal reservoir of the virus; between 1940 and 1951 neutralizing antibodies to the virus of yellow fever have been demonstrated in the sera of captured specimens of *Papio papio*, *Cercopithecus aethiops* and *Erythrocebus patus*. *G. Stuart*

Lartigaut & Couteau. Encéphalite bénigne après vaccination contre la fièvre jaune par le vaccin atténué en tissu embryonnaire. [**Mild Encephalitis after Yellow Fever Immunization with Vaccine prepared from a Strain of Virus attenuated by Cultivation in Embryonic Tissue**] *J. Méd. de Bordeaux.* 1954, May, v. 131, No. 5, 506–7.

After briefly indicating the various types of reaction which have been reported to follow vaccination with the egg-adapted strain of yellow fever virus (17D), the authors provide an example of the rarely occurring nervous reaction by citing from their own experience a case of meningo-encephalitis recently associated with the use of this immunizing strain. The case was in respect of a 4-months-old male infant, who had been vaccinated on 10th December 1953 and had remained perfectly well until 18th December, when he showed disinclination for food, developed high fever (39·4–39·8°C.), had an attack of vomiting and continued to be drowsy throughout the day. Next morning the temperature remained high; at 9 a.m. he had a shivering fit after his breast feed; at 1 p.m. he had bilateral convulsions lasting 3–4 minutes; thereafter he was rigid for nearly one hour, with irregular respirations; he was pale and exhausted. On admission to hospital at 5 p.m. he was of good colour, his respiration was normal, his Kernig sign was negative, and physical examination revealed no abnormality in chest, abdomen or fontanelles. The cerebrospinal fluid, however, contained 0·80 per cent. albumin and 238 cells per cmm. (69 per cent. lymphocytes, 23 per cent. polymorphonuclears).

During the following (the 10th post-vaccination) day the temperature fell to normal and recovery was uneventful.

The authors explain their delay in submitting for publication an account of the case now described on the ground that at the time they believed vaccination with the modified strain they employed to be without risk of nervous reactions. They now consider, in the absence of any evidence to the contrary, that the vaccine virus was the agent responsible for the occurrence.

[From 1942—since the establishment of the seed lot system in the production of 17D virus vaccine—there had been no occurrence of encephalitis following 17D vaccination until 1952–53, when 5 cases were reported in France, all in children under one year old. (Stuart, 1954, *African Seminar on Yellow Fever*, WHO Regional Office for Africa, Brazzaville, p. 151; this *Bulletin*, above, p. 143.)] *G. Stuart*

See also p. 148, Dinger, Immuniteitsbetrekkingen tussen dengue en gele koorts [**Immunity Relationship of Dengue and Yellow Fever**].

See also p. 124, Sautet & Aldighieri, La lutte contre le paludisme et celle contre la fièvre jaune doivent-elles être toujours dissociées? Quelques exemples guadeloupéens [**Should Control Measures against Malaria and Yellow Fever always be Separate? Some Examples from Guadeloupe**].

DENGUE AND ALLIED FEVERS

Rosen, L., Rozeboom, L. E., Sweet, B. H. & Sabin, A. B. **The Transmission of Dengue by** *Aedes polynesiensis* **Marks.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 878–82. [13 refs.]

The authors have demonstrated the transmission of dengue from a cynomolgus monkey (*Macaca irus*), which had been inoculated intraperitoneally with serum from a dengue patient, to another cynomolgus monkey and to two rhesus monkeys (*Macaca mulatta*) by the bites of *Aëdes polynesiensis*.

Details are given of the experiments in which strict precautions were taken to ensure the reliability of the findings. From 82 to 110 mosquitoes were fed on each of the recipient monkeys. The mosquitoes were divided into 3 lots one of which fed on the donor monkey 4 days after it had been inoculated and on the recipient monkeys 16 days later; for the second lots the corresponding days of feeding were 6 and 14 days and for the third lot 8 and 12 days.

The occurrence of dengue in the monkeys was diagnosed by the haemagglutination-inhibition test for the presence of antibodies of the disease. The other mosquitoes known to be capable of transmitting dengue are *Aëdes aegypti*, *A. albopictus* and *A. scutellaris*. *A. polynesiensis* belongs to the *scutellaris* group of the subgenus Stegomyia as do 17 species in the Australian region so that there may be other vectors belonging to this group. Rhesus and cynomolgus monkeys have been shown by Blanc *et al.* [this *Bulletin*, 1929, v. 26, 838] and by other observers to be susceptible to dengue, and Simmons *et al.* [*ibid.*, 1931, v. 28, 613] suggested that they might play a part in the epidemiology of the disease; the present experiments favour this suggestion which raises the question of the possible occurrence of " jungle dengue " analogous with jungle yellow fever.

John W. D. Megaw

Dinger, J. E. Immuniteitsbetrekkingen tussen dengue en gele koorts. [**Immunity Relationship of Dengue and Yellow Fever**] *Nederl. Tijdscher. v. Geneesk.* 1954, Aug. 7, v. 98 (iii), No. 32, 2206–11. English summary (4 lines).

Eighteen mice were immunized with 3 intraperitoneal inoculations of the Hawaii strain of dengue virus and challenged with an intraperitoneal injection of neurotropic yellow fever virus together with an intracerebral injection of starch; 11 mice survived, compared with 3 survivors from a control group of 10 mice which were not immune to dengue. In 2 similar experiments there were 16 survivors out of 42 dengue-immune mice and 2 in a control group of 11; and 42 of 73 immunes and 8 of 19 controls respectively. There was no evidence of cross-immunity in an experiment in which the injection of neurotropic yellow fever virus was repeated within 24 hours (18·9 per cent. and 17·6 per cent. of survivors from immune and control groups of 37 and 17, respectively). *D. J. Bauer*

RABIES

World Health Organization. Technical Report Ser. No. 82. **Expert Committee on Rabies. Second Report.** Rome, 14–19 September 1953. 27 pp., 3 figs. Geneva: 1954, Apr. [1s. 9d.; $0.25; Sw.fr. 1.–.]

This report deals in general with the overall problems encountered in rabies, including prophylaxis in human beings and control in animals, considers the results of recent WHO-sponsored investigations, including field trials in the use of hyperimmune serum-vaccine as a preventive measure for rabies in man and in the use of egg-adapted virus vaccine in dogs for the control and eradication of rabies, and formulates technical recommendations in the light of advances in the field of rabies during the past few years. The report covers the items on the Committee's agenda in the order indicated in the following paragraphs.

Results of field trials in Israel and Malaya show mass immunization of dogs with chicken-embryo vaccine to have been the decisive factor in achieving and maintaining a low incidence of rabies in those parts of the territories involved. New developments in antirabies vaccines mainly concern chick-embryo vaccines and vaccine potency tests. The Flury strain at its 180th egg passage level has proved to be antigenic for dogs and cattle and entirely devoid of pathogenic properties for the latter animals. It is recommended that every batch of chicken-embryo vaccine (Flury and Kelev strains) should be submitted to the guineapig potency test devised by Koprowski. Such vaccines cannot yet be recommended for human prophylaxis. The field trial conducted in Iran to evaluate the use of hyperimmune serum followed by vaccine in the post-exposure treatment of human beings bitten by rabid wolves failed to yield results of statistical significance. Results of serum-virus neutralization tests on non-exposed persons who had received hyperimmune serum and varying doses of vaccines showed that, for the maintenance of continuous antibody over a period, the combined use of a single dose (0·5 ml. per kgm. of body weight intramuscularly) of hyperimmune serum and 14 subsequent daily doses of phenolized vaccine was most effective. Indications for specific post-exposure treatment of man differ from those given in the Committee's first report [this *Bulletin*, 1951, v. 48, 32] mainly with respect to treatment after severe exposure (multiple, or face, head or neck bites), in which case the immediate use of hyperimmune serum followed by a course of vaccine is now advocated. Recommendations in respect of rabies control in animals closely follow those made in the Committee's first report [*loc. cit.*]; the fact that chicken-embryo vaccine (Flury strain) has been shown to produce highly satisfactory immunity in dogs for at least 3 years following a single intramuscular injection, however, has now permitted alternatives to those earlier recommendations regarding the pre- and post-exposure immunization of these animals. The need is stressed for greater rapidity and accuracy in the diagnosis of rabies; such may be achieved by means of improved staining techniques for the detection of Negri bodies, the mouse inoculation test for the isolation of the rabies virus, and the serum-neutralization test as a specific confirmatory procedure. Isolation of the virus from the submaxillary salivary glands of biting animals is also recommended as a means of providing definite evidence of whether or not a bite has entailed a risk.

A number of suggestions for future research completes the body of the report: studies on veterinary vaccines, on the value of hyperimmune serum in human treatment, on the antibody response in human beings to varying doses of vaccines with and without hyperimmune serum, and on

chemotherapy. These suggestions are additional to those made in the Committee's first report [*loc. cit.*] which are still in the course of implementation.

Three annexes to the report contain, respectively, a summary of results of field trials in Israel and Malaya with chicken-embryo vaccine, suggested minimum requirements of antirabies hyperimmune serum, and information on the epizootiology of wild-animal rabies. *G. Stuart*

Nikolitsch, M. Biologische Eigenschaften des Flurystammes des Tollwutvirus. [**The Biological Characters of the Flury Strain of Rabies Virus**] *Arch. f. Hyg. u. Bakt.* 1954, Oct., v. 138, No. 6, 399–407, 1 chart.

The English summary appended to the paper is as follows:—

"The author checked the observations described by Remlinger and coworkers [this *Bulletin*, 1953, v. 50, 1037] and confirms their results. He further ascertained that, if i.c. inoculated, this virus paralyses the brain center with respect to its power of regulating the body temperature. This means that the body of the diseased animals will assume the temperature of its surroundings. It is recommended to refrain from practical application of the antirabic vaccines of the Flury strain until such time as the properties of this virus will be more fully known."

Shahin, I. M. **Intracytoplastic Inclusions in Human Rabies.** *J. Egyptian Pub. Health Ass.* 1953, v. 28, No. 6, 113–24, 10 figs. on 3 pls. [19 refs.]

In this article the author describes the appearance and distribution of intracytoplasmic inclusion bodies demonstrated by various staining methods in sections prepared from the brain tissues of 18 cases of human rabies and discusses the significance which may be attached to the occurrence of such inclusion bodies in nerve cells affected by street-virus rabies. For his detailed histological investigations of sections cut in each case from Ammon's horn, cerebral cortex, mid-brain, medulla oblongata and cerebellar cortex, the author found the carbol-fuchsin-methylene-blue technique he describes in the text to be of greater value than any of the other routine staining methods he used, because it permitted a colour differentiation between the larger inclusions (Negri bodies measuring up to 25 μ and possessing a definite internal structure) and the smaller inclusions (micro-bodies, fine granules or minute formations, measuring about 0·5 μ, possessing no internal structure, and ordinarily present also in the general substance of the affected cell body). In sections treated with carbol-fuchsin-methylene-blue, Negri bodies were stained either greenish blue with violet-black inner granules or else they assumed a dull pink colour which, as a rule, obscured the internal structure; the micro-bodies appeared as fine granules overstained with fuchsin.

These minute fuchsin-stained granules—in contrast with the distribution of the Negri bodies, which are limited to Ammon's horn and cerebral cortex —were observed in all parts of the brain examined, were either dispersed freely throughout the cell body or, in Ammon's horn and cerebral cortex, contained within irregular, unstained, cyst-like spaces; but, whatever their intracellular distribution, they showed in most instances a diplococcal arrangement, clear, unstained zones often surrounding one or two pairs of inclusions. In the author's view these minute intracytoplasmic inclusions are elementary bodies, *i.e.*, virus units, and are identical with the units

making up the internal structure of Negri bodies, with the difference that, because of the nature of their intracellular distribution, they take up suitable stains more readily than their counterparts embedded within the hyaline eosinophilic groundwork of Negri bodies. On this conception, the Negri body is not the active infective unit but represents a specific reaction around the virus—a reaction which occurs, however, on a very limited scale.

[These views correspond with those frequently expressed in the past, namely, that the smaller internal formations (*kleine Innenformationen*) may be the infective agent in its essential form and that the Negri body is the result of a cellular reaction to invasion by these minute forms.]

G. Stuart

Ahuja, M. L. & Suri, J. C. **Local Treatment of Bites inflicted by Rabid Animals.** *Indian J. Med. Res.* 1954, July, v. 42, No. 3, 485–8.

The need for studies on the comparative values of corrosive acids and non-corrosive agents in the local treatment of wounds infected with rabies virus has frequently been emphasized. In their attempt to provide data on which such evaluation might be based, the authors carried out a series of experiments in which guineapigs were inoculated intramuscularly with a strain of street virus capable of causing at least 80 per cent. mortality among untreated animals. The guineapigs had their wounds treated, 30 minutes after infection, by cauterization with carbolic acid or fuming nitric acid, or by application of methylated spirit, or by irrigation with 1 per cent. soap solution.

Results showed among animals treated by these 4 methods mortality rates of 57, 53, 76 and 70 per cent., respectively, compared with a rate of 80 per cent. among the untreated controls. Irrigation with 1 per cent. soap solution or application of methylated spirit did not appear, therefore, to have a significant effect on reducing the chances of the animals developing rabies when a virus of high virulence was employed as the test infection; on the other hand, the use of carbolic or fuming nitric acid as a cauterizing agent reduced the chances of rabies developing in the proportion of about 10 to 7. Results of further experiments showed cauterization of wounds, followed by antirabies vaccination, to be the best line of treatment, the chances of rabies developing being thereby further reduced in the proportion of 10 to 2, *i.e.*, for every 10 deaths among the untreated animals only 2 deaths occurred when cauterization with strong corrosives was employed as local treatment, followed by a course of antirabies vaccine. [In their experiments devised to assess the value of local treatment, Shaughnessy and Zichis [this *Bulletin*, 1954, v. 51, 1239] inoculated guineapigs intramuscularly with a strain of fixed-virus rabies, which consistently infected these animals by the intramuscular route, and treated their wounds, after intervals of varying duration, with different viricidal substances. These authors found that cauterization with fuming nitric acid gave no greater protection against the development of rabies than did irrigation with a 20 per cent. soap solution. One per cent. Zephiran chloride—a cationic detergent—proved to be the material of choice.] *G. Stuart*

D'Silva, C. B. & Ahuja, M. L. **A Brief Note on Results of Field Trials with Antirabic Vaccine prepared in Distilled Water.** *Indian J. Med. Res.* 1954, July, v. 42, No. 3, 481–3.

Because of the fact that a Semple-type antirabies vaccine prepared in distilled water had been found by D'Silva *et al.* [this *Bulletin*, 1952, v. 49,

1040] to afford as good protection to experimental animals as one prepared in normal saline solution and to evoke in such animals a more rapid immunity response, the vaccine taken into routine use on 1st January 1951 for the treatment of human beings in areas receiving their vaccine supplies from the Central Research Institute, Kasauli, was one consisting of 5 per cent. sheep brain in a final concentration of 0·5 per cent. phenol in distilled water. In the present paper a comparison is made between the results obtained, both in experimental work and in the treatment of human beings, from the use of vaccines prepared, respectively, with distilled water and with normal saline solution as menstruum. Results of experimental work showed vaccine prepared in normal saline solution to be as effective in affording protection in the pre-infection treatment of guineapigs infected with street virus as that prepared in distilled water; vaccine prepared in distilled water proved, however, to immunize more rapidly and to confer better protection in the post-infection treatment of these animals. Among 136,545 persons treated in the period 1943–1950 with vaccine prepared in normal saline solution, 417 (0·3 per cent.) died of rabies; among 28,104 treated in 1951–1952 with vaccine prepared in distilled water, 9 (0·03 per cent.) died of rabies. *G. Stuart*

PLAGUE

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, rodent hosts, transmission, pathology, diagnosis, clinical findings, treatment, control.

Schmitz-Cliever, E. Ein Beitrag zur Epidemiologie der Pestpandemie von 1664/67. [**The Plague Pandemic of 1664–1667**] *Arch. f. Hyg. u. Bakt.* 1954, Oct., v. 138, No. 6, 440–44.

Ames, C. T., Quan, S. F. & Ryckman, R. E. **Triatominae in Experimental Transmission of Plague.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 890–96, 1 fig. [12 refs.]

The authors describe attempts to transmit plague by Triatominae, of which 8 species were employed in the experiments. *Pasteurella pestis* was found to survive in suspensions of infected *Triatoma protracta* for 3 days at 30°C. but not for 5 days.

Plague infection was transmitted to two mice, in each case by the bites of two *Triatoma phyllosoma pallidipennis* which had immediately beforehand been interrupted while feeding on an infected mouse. Infection was regarded as having resulted from the presence of bacilli on the contaminated mouth parts of the bugs. In 13 similar experiments, in which 13 mice and 41 Triatominae of 5 other species were used, no infection resulted; 8 of these mice had been bitten by 32 bugs immediately after an interrupted meal, the other 5 were bitten by 9 bugs 8–12 hours or 6 days after the meal.

Among 13 experiments in which laboratory mice were allowed to ingest infected Triatominae 3 mice developed primary pneumonic plague which was regarded as having resulted from the aspiration of infected material into the lungs. In 9 experiments in which Triatominae infected with *Trypanosoma cruzi* and with *P. pestis* were fed to mice 4 of the animals

became infected with plague; only one of the cases was of primary pneumonic plague.

In a series of 17 tests for the presence of virulent *P. pestis* in the faeces of Triatominae which had recently fed on infected mice only one of the mice employed became infected after inoculation with the faeces of 2 *Triatoma platensis* which had fed on an infected mouse 15 minutes earlier. No infection was found in the faeces of 13 Triatominae of other species which had also been infected 15 minutes before the collection of the faeces. The faeces of 18 *Triatoma protracta* collected 6 hours to 7 days after the infecting meal failed to infect any of the 9 mice that were tested.

John W. D. Megaw

Ryckman, R. E., Ames, C. T., Lindt, C. C. & Lee, R. D. **Control of Plague Vectors on the California Ground Squirrel by Burrow Dusting with Insecticides and the Seasonal Incidence of Fleas Present.** *J. Econom. Entom.* 1954, Aug., v. 47, No. 4, 604–7, 4 figs.

A dustgun was used to inject 30 gm. dust and insecticide into the entrance of each of the ground squirrel burrows in several fields. Four fields were treated in October 1952, each with a different insecticide as follows: 2·5 per cent. heptachlor, 5 per cent. DDT, 2 per cent. dieldrin, and 2·5 per cent. aldrin. A fifth field was observed untreated for control data. The fields were separated by electrical fencing.

From pre-treatment indices of 128, 318 and 111 fleas per animal, the flea index on the ground squirrels dropped 3 or 4 days after the treatment to less than 1 flea per squirrel for aldrin, dieldrin and heptachlor respectively; for DDT the decline in the index was from 258 to 107 fleas per animal. About a month to 6 weeks later the control index had shown a seasonal drop from 171 to 99·6 fleas per squirrel, DDT gave a reduction to an index of 6·9 and the other 3 insecticides still maintained the very low flea indices. Nine months after treatment (July 1953) the control index was 304·8 fleas per squirrel and for the insecticides the index values were 242·5 (DDT), 4·3 (heptachlor), 11·1 (aldrin) and 23·2 (dieldrin). A year after the treatment, that is, in October 1953, after the seasonal multiplication of the fleas in the intervening summer, the indices for all the 4 insecticides were either similar to the index for the control field or sufficiently large to indicate that effective control had ceased. The insecticides tested appeared to give satisfactory control for 9 months, with the exception of DDT.

Other work to test these insecticides when sprayed into burrows, or over the entire surface of the field, or dusted on the soil and vegetation of a field, is in progress.

D. S. Bertram

CHOLERA

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, pathology, diagnosis, clinical findings, treatment, control.

Sarkar, J. K. & Tribedi, B. P. **Growth and Survival of Cholera Vibrio in relation to pH.** *Indian Med. Gaz.* 1954, Mar., v. 89, No. 3, 139–41.

The authors have studied the changes of *p*H produced in heart extract nutrient broth, and peptone water, by the growth of *Vibrio cholerae* alone,

and in mixed culture with *Bacterium coli*. The following table taken from the results obtained shows the changes observed with *V. cholerae*.

*p*H	at 24 hours	after 6 days	after 20 days
Broth 7·0	5·5 to 5·7	5·7 to 5·8	5·7 to 5·8
,, 7·4	5·6 to 6·0	5·7 to 6·0	5·9 to 6·0
,, 7·6	5·7 to 6·2	6·0 to 6·4	8·0
,, 7·9	7·0	7·3	8·0
,, 8·4	7·0 to 7·2	—	—
Peptone Water 7·6	7·2	7·8	8·0
,, ,, 7·9	7·4	8·4	8·5

The *p*H of a broth culture of *Bact. coli* fell from 7·6 to 7·2 in 24 hours and rose to 8·2 after 6 days and to 9·0 after 20 days. A peptone water culture of *Bact. coli* fell from 7·9 to 7·8 in 24 hours, rose to 8·5 in 6 days and was 8·5 after 20 days. It is probable that the peptone acts as a buffer and that this is the reason why peptone water is a better medium for *V. cholerae* than nutrient broth. Non-agglutinable vibrios produced less acid than *V. cholerae*.

When a loopful of *V. cholerae* culture was added to a culture of *Bact. coli* in nutrient broth of *p*H 7·6 the *p*H after 48 hours was 8·2. After 7 days it was 8·8 and at the end of 20 days it was 9·2 and *V. cholerae* was the only organism present in sub-culture. A similar result was obtained when the *p*H of the original culture was 9·3. In peptone water, however, at 7·9 both organisms survived for 50 days and the *p*H was then 8·5.

The authors conclude that the viability of a culture of *V. cholerae* depends on the *p*H of the medium brought about by the growth of the organism. They have therefore studied the *p*H of tanks at Calcutta and Burdwan, and of the Hooghly river at Calcutta, during a period of two years. The average *p*H of the tank water was 7·9 in January and February, 8·0 to 8·1 in March and April. From June to December it fell to 7·7 to 7·8. The *p*H of the Hooghly river was always 8·0 to 8·1 except once in July when it was 8·4. The average *p*H of water in that part of Bengal is thus favourable for the survival of *V. cholerae*. *C. C. B. Gilmour*

Malizia, W. F. **Antigenic Relationship between Species of** *Paracolobactrum* **and** *Vibrio comma*. *U.S. Armed Forces Med. J.* 1954, Oct., v. 5, No. 10, 1528–30.

[The *Paracolobactrum* species referred to included organisms now known as the Bethesda and Arizona groups.] Saline suspensions (heated for 2 hours at 100°C. and preserved with 1 in 10,000 merthiolate) of 120 strains of *Paracolobactrum coliforme*, 10 of *P. aerogenoides*, 10 of *P. intermedium*, 10 of the Bethesda group and 10 of the Arizona group were tested for agglutination with sera prepared from Inaba and Ogawa strains of *Vibrio cholerae*. When "HO" antisera were used, 4 strains of *P. coliforme* agglutinated with Inaba and Ogawa sera, 3 with Inaba sera only, and 8 with Ogawa sera only. One strain of Bethesda organisms agglutinated with the Inaba and Ogawa sera, 4 with Inaba serum only and 1 with Ogawa serum

only. Four strains of *P. intermedium* agglutinated with Ogawa serum only. The degree of agglutination varied from 2 to 4 plus. None of the 10 strains of Arizona organisms and *P. aerogenoides* was agglutinable.

Those strains which gave a 3 to 4 plus reaction were tested with Inaba serum absorbed with Ogawa (C) and Ogawa serum absorbed with Inaba (B).

Seven strains of *P. coliforme* and 2 of *P. intermedium* and 4 of the Bethesda organisms were tested, and 1 strain of the Bethesda group was agglutinated by the single-factor (C) serum to about 12·5 per cent. of the titre against the homologous organism.

The author concludes that there is an antigenic relationship between some of these organisms and some cholera vibrios and that this relationship is fairly close in the case of the Bethesda organisms. *C. C. B. Gilmour*

AMOEBIASIS AND INTESTINAL PROTOZOAL INFECTIONS

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, pathology, diagnosis, clinical findings, treatment, control.

Lynch, J. E., English, A. R., Bauck, Harriet & Deligianis, Helen. **Studies on the *in vitro* Activity of Anisomycin.** *Antibiotics & Chemotherapy.* New York. 1954, Aug., v. 4, No. 8, 844–8.

Anisomycin (Flagecidin, Pfizer) is a new antibiotic the initial description of which is stated still to be in press. This paper describes only tests of its capacity to inhibit the growth of various micro-organisms *in vitro*. It has very little activity against bacteria or against most fungi, but a high degree of activity against *Candida albicans*, *Trichomonas vaginalis*, *Trichomonas foetus* and *Entamoeba histolytica*. The action on the last-named was not an indirect one since the bacteria necessarily accompanying it were insusceptible to the antibiotic. Minimum inhibitory concentrations of 18 other drugs for these three protozoa are given: anisomycin is the most active of all against both species of *Trichomonas* and second only to fumagillin in activity against *E. histolytica*. Studies of its action on protozoa *in vivo* are in progress. *L. P. Garrod*

Blanc, F. L'amibiase colique et son traitement. [**Intestinal Amoebiasis and Its Treatment**] *Arch. Méd. Gén. et Trop.* 1954, May–June, v. 31, No. 3, 223–33.

This paper, as the title implies, deals with the author's conception of the nature of intestinal amoebiasis and his views on its treatment. It does not contribute any fresh knowledge to the subject; the drugs advocated in treatment are those which have been favoured by the French school of workers during recent years. *A. R. D. Adams*

Wen, Shih-yü & Li, Kuang-hsü. **Amebic Granuloma of the Colon.** Review of Literature and Report of a Case. *Chinese Med. J.* Peking. 1954, July–Aug., v. 72, No. 4, 264–71, 4 figs. on 2 pls. [16 refs.]

Deb, P. N. **Pulmonary Amoebiasis masquerading as Pulmonary Tuberculosis.** *J. Indian Med. Ass.* 1954, Oct. 16, v. 24, No. 2, 62–3.

Report of a case.

Piedrahíta R., A. Amebiasis cutanea y genital. [**Cutaneous and Genital Amoebiasis**] 16 pp., 12 figs. (1 coloured) on 12 pls. [13 refs.] 1952. Medellin.

After some general remarks on cutaneous amoebiasis and phagedaenic ulceration of the penis the author gives details of 8 cases under his own observation. There is nothing calling for special attention; 5 of them were examples of perineal ulceration and 3 of the phagedaenic type of ulcer of the penis and scrotum adjacent. As soon as the diagnosis was determined, specific treatment was given and recovery followed. The condition is well shown by photographs. *H. Harold Scott*

Bellelli, L. & Onori, E. Prove di funzionalità surrenalica prima e dopo terapia emetinica. [**Adrenal Function before and after Emetine Treatment**] *Arch. Ital. Sci. Med. Trop. e Parassit.* 1954, Mar., v. 35, No. 3, 107–19. [48 refs.] English summary (5 lines).

The authors have selected for their study 19 subjects, including persons of both sexes and representing ages of 20 to 60 years. All subjects showed, in a varying degree, a deficiency of the liver function. Most were suffering from intestinal amoebiasis. A few showed liver complications, 3 having a liver abscess.

The following investigations were carried out in each case: (1) estimation of blood potassium by the method of Kramer and Tisdall; (2) the blood sodium by Müller's method; (3) the blood chlorides according to Mandel and Stendel; (4) Kepler's constant for the water-saline exchange; (5) estimation of the 17-ketosteroids by the technique of Grisler and Bonessa.

The results are shown in a table which gives, for each case, clinical data, age, diagnosis, emetine dosage and duration of its course, pulse rate, blood pressure, body weight before and after treatment. The emetine was given by intramuscular injection. Nine of the subjects were aged between 30 and 50, 6 were 50 or over, 4 were between 22 and 30. Most of them were in good general condition. All were kept strictly at rest during treatment.

A second table shows, for each case, the total amount of emetine given, and the results of the laboratory investigations outlined under the 5 headings set above. Only 4 subjects showed any appreciable changes in blood salts. Neither Kepler's constant nor the rate of 17-ketosteroids in the urine showed any change as the result of emetine treatment. There was a fall in the blood pressure of 3 subjects and there were changes in the pulse rate of a number of subjects. The authors conclude that, in their hands, therapeutic doses of emetine have not resulted in any appreciable effect on the function of the adrenal glands. *J. Cauchi*

Hoekenga, M. T. & Batterton, Dorothy L. **Trial of Diallyl-Diethyl-Aminoethyl Phenol Dihydrochloride (Camoform) in Human Amebiasis.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 849–51.

Camoform (Parke, Davis & Co.) [SN 6771 of the recent American malaria drug-screening programme] is structurally related to amodiaquine [Camoquin]; it is a basic diphenol containing neither iodine nor arsenic. It is a

white crystalline substance which is readily soluble in water to more than 10 per cent. concentration. It is amoebicidal *in vitro* in dilutions up to 1 in 50,000; and it is well tolerated by animals and by man. It can be manufactured economically.

Unpublished work in S. America has suggested that the drug effectively arrests acute amoebic dysentery, and that it sterilizes an *Entamoeba histolytica* bowel infection when given over 5 days. The authors treated with Camoform 10 Honduras patients with acute amoebic dysentery and 10 with asymptomatic amoebiasis. The dosage for each of 18 adults was 0·5 gm. thrice daily [presumably by mouth] for 7 days; that for a child of one year was 0·75 gm. daily for 7 days; and that for a child of 6 years was the same for only 3 days. Relief of symptoms was complete within 2 to 5 days; and the stools were freed of parasites in all but one case by the second day of treatment. Stools were subsequently examined on at least 6 occasions over periods of 3 to 4 months thereafter; 17 of the 20 patients remained stool-negative and asymptomatic during the period of observation; 3 relapsed parasitically, and in 2 of these cases there were clinical relapses. No toxic side-effects appeared during, or after, the treatment. *A. R. D. Adams*

RELAPSING FEVER AND OTHER SPIROCHAETOSES

Özsan, K. & Akyay, N. La fièvre récurrente en Turquie. Présence dans le sud (frontière turco-syrienne) d'*Ornithodorus erraticus* infecté d'un spirochète du groupe *Crocidurae*. [**Relapsing Fever in Turkey. Presence of** *Ornithodorus erraticus* **Infected with a Spirochaete of the** *Crocidurae* **Group in South Turkey (Turco-Syrian Border)**] *Bull. Soc. Path. Exot.* 1954, v. 47, No. 4, 501–3.

Davis, G. E. & Burgdorfer, W. **On the Susceptibility of the Guinea Pig to the Relapsing Fever Spirochete** *Borrelia duttonii*. *Bull. Soc. Path. Exot.* 1954, v. 47, No. 4, 498–501.

"As a result of these studies with eight strains of *Borrelia duttoni*, five of which were recovered from *O. moubata* and three from patients in widely separated areas, it is concluded that the guinea pig is not susceptible to *B. duttoni* according to the usual methods of examination."

Browning, T. O. **On the Structure of the Spiracle of the Tick,** *Ornithodoros moubata* **Murray.** *Parasitology.* 1954, Nov., v. 44, Nos. 3/4, 310–12, 1 fig.

Gimeno de Sande, A. Aureomicina en la fiebre recurrente española. [**Aureomycin in Spanish Relapsing Fever**] *Rev. Sanidad e Hig. Pública.* Madrid. 1954, May–June, v. 28, Nos. 5/6, 342–55. [22 refs.]

The author in this paper deals with 68 patients whom he divides into 2 groups. In the first were 31 who came to hospital with fever and in whose blood the spirochaetes were present; in the second were 38 who were afebrile

and showed no spirochaetes in their peripheral blood, but had done so a few days before. The drug was given in an initial dose of 500 mgm. and thereafter 250 mgm. every 6 hours to a total of 3 gm. When it was seen in 12 of the patients that there were neither complications nor relapse, the total dose was reduced to 2 gm. Children were given 5–10 mgm. per kgm. body weight every 6 hours to a total of 2 gm.

Two hours after the first dose there might be a rise of temperature to 41°C. and a soft thready pulse, but spirochaetes were not seen in a thick drop of the peripheral blood and these symptoms were ascribed to intense lysis of the spirochaetes. A month earlier a child had been given a single dose of 250 mgm. (his weight was 35 kgm.). In 3 hours the child groaned, seized his head in his hands and complained of intense pain; in 5 hours he was in a deep coma, with rapid, low tension pulse and cold extremities; temperature 41°C. in the axilla, pupils dilated, rigidity of the neck, convulsive movements and incontinence of the sphincters, ending in death.

Of the author's 31 patients in group I, 17 were first infections, 14 were second or later attacks. From the former, spirochaetes disappeared from the blood, on an average in 3 hours, the limits being under 1 and up to 18 hours; from the latter, in 2 hours, with limits of under 1 and up to 6 hours. The temperature fell in 12 hours in half the patients and in 24 hours in the rest. In all the 31 there was an early reaction—in the majority in 2 hours—after taking the drug, the symptoms being a rise of 1–1·5°C. in the temperature, malaise, with rapid heart action, soft pulse and intense headache. As this is the time when concentration of the drug in the blood is highest, the symptoms are ascribed to massive spirochaetolysis. As for the 37 apyretic patients, they similarly showed a rise of temperature to 37·5° or perhaps 38°C. in 2–3 hours after the first dose.

Of the 68, except for one woman who a fortnight after leaving hospital returned with spirochaetes in her blood, there were no relapses. This patient was thought to have been re-infected as she had been staying away and had been repeatedly bitten by insects [? lice].

All the doctors whose patients had been admitted to hospital were asked to report any relapses, but none had been so reported, though 31 had left hospital three months before, 19 two months and 28 one month [these total 78]. *H. Harold Scott*

Juárez, E. La fiebre recurrente española y su tratamiento con terramicina. [**Terramycin the Treatment of Spanish Relapsing Fever**] *Rev. Sanidad e Hig. Pública.* Madrid. 1954, May–June, v. 28, Nos. 5/6, 356–61. [25 refs.]

The author states that last summer he treated 54 relapsing fever patients with aureomycin—a total dosage of 2 gm., 500 mgm. every 6 hours for adults, half this for children (but only 2 of them were children). He now reports the results of trying terramycin [oxytetracycline] in the same way for 8 patients whose details are given at the end of the paper. Four of them returned with relapses, 10, 13, 17 days and about a month respectively after the treatment ended. Though very few patients were treated the author concludes that terramycin is far inferior to aureomycin in the treatment of Spanish relapsing fever. *H. Harold Scott*

LEPROSY

In this section abstracts are arranged as far as possible in the following order:—epidemiology, aetiology, pathology, diagnosis, clinical findings, treatment, control.

Gay Prieto, J. & Contreras, F. Inmunidad y contagio en el adulto. [**Immunity and Contagion in the Adult**] *Rev. " Fontilles ".* Valencia. 1954, July, v. 3, No. 6, 479–83.

An account is given of an adult person who repeatedly inoculated himself with blood from lepromatous patients, but failed to develop leprosy. A list is then given of 136 past and present patients at the Fontilles leprosarium who considered that they had contracted leprosy after 40 years of age. Careful enquiry into all these cases cut down the number who could not have been infected before the age of 40 to 7 patients, the individual histories of whom are given. Comparing the case of the adult who failed to infect himself voluntarily with the 7 patients who acquired the disease involuntarily after the age of 40, the authors come to the following conclusions: children are most exposed to infection and acquire the disease more easily. There is, however, a certain amount of danger for adults, although their immunity is higher, and at all ages adequate care should be taken, especially by those who attend to patients suffering from leprosy.

Ernest Muir

Montestruc, E. Quatre exemples de lèpres familiales (enfants atteints avant les parents). [**Four Examples of Familial Leprosy in which Children were affected before the Parents**] *Rev. Coloniale de Méd. et Chir.* 1954, Oct. 15, v. 26, No. 228, 182–4.

In the four cases described the children showed the disease approximately 1, 6, 3 and 5 years respectively before the parents. The types of disease in the four children were respectively lepromatous, indeterminate, tuberculoid and lepromatous, and of the adults indeterminate in the first and lepromatous in the other 3.

Three possible explanations of these unusual occurrences are discussed: the adults might have been infected by the children; the children might have been infected by the adults in whom the disease might have been present in an infectious but unrecognized form; parents and children might have been infected by an unknown third party. The author is in favour of the last of these three hypotheses. [He does not mention what efforts were made to discover the third parties.]

Ernest Muir

i. Suter, E. **Some Aspects of Intracellular Parasitism of Pathogenic Microorganisms.** A Review. *Internat. J. Leprosy.* New Orleans. 1954, Jan.–Mar., v. 22, No. 1, 1–11, 3 figs. [27 figs.]

ii. Hanks, J. H. **The Implications of Suter's Review of Intracellular Parasitism with respect to the Problem of Leprosy.** *Ibid.*, 12–15.

iii. Wade, H. W. **Intracellular Parasitism of Mycobacteria. Suter's Review, and Hanks' Commentary.** [Editorial.] *Ibid.*, 81–5.

The first of these papers is a review of the subject of intracellular parasitism; the second, carrying the subject further, shows how intracellular

parasitism may be used in the study of chemotherapeutic agents; the third is an editorial note on the first two papers.

i. While in acute conditions phagocytosis generally results in the organisms engulfed being destroyed, in chronic conditions the engulfing cell may help to protect the organism from destruction when the latter is sensitive to components of the serum. Thus infective agents like *Brucella*, *Salmonella* and tubercle bacilli, though sensitive to streptomycin *in vitro*, remain viable inside cells in animals treated with this antibiotic. In animals infected with tuberculosis the effect of streptomycin is apparent only 12 or 15 days after infection, and it is suggested that the delay is due to protection of the bacilli inside cells until hypersensitivity has developed causing the destruction of the containing cells and thus allowing the bacilli to come in contact with the antibiotic. *In vitro*, larger concentrations of streptomycin are necessary to inhibit growth of bacilli growing inside phagocytes than to inhibit growth in a liquid medium. This principle is illustrated by reference to several experiments in which both tubercle bacilli and *Brucella* organisms were used. "Brucellosis might be compared superficially with leprosy. In either infection the pathogen finds a hostile environment in the body fluids but manages to survive within phagocytic cells. In the case of brucella the active factor has been identified as an antibody; in leprosy it is probably natural inhibition."

The technique is described of cultivating macrophages derived from peritoneal exudates, and uniformly infected with tubercle bacilli, in a single layer on coverslips, so that they may be easily handled and conveniently examined under the oil-immersion objective. It was found that macrophages from animals immunized with BCG can suppress bacillary proliferation. This is of importance in understanding the pathogenesis and immunity of tuberculosis. Virulent bacilli, on the other hand, can escape the phagocytes by means of their destructive capacity and establish extracellular foci in which they are no longer exposed to the inhibitory effect of the macrophages.

The question of immunity in leprosy is discussed: either the phagocytes acquire the power to inhibit or eliminate the bacilli, or a higher degree of cellular sensitivity is established which brings about destruction of the phagocytes loaded with bacilli which in turn become exposed to an unfavourable extracellular environment.

ii. Hanks expresses the view, as the result of his work with rat leprosy in rats, that "a notable combination of metabolic limitations and of inhibitions by extracellular fluids are the main factors which force the fastidious and noncultivated species towards seclusion in intracellular environment". It is suggested that *Myco. leprae* may operate at much lower metabolic levels than either *Myco. leprae murium* or intracellular tubercle bacilli, as shown by its slow growth even in the most susceptible human hosts, and the frequent failure to transmit leprosy experimentally even within the natural host. It may on this account prove disappointing to search for drugs with dramatic effects, seeing that a low metabolic response in an organism "imposes severe limitations on the effectiveness of antimetabolic drugs". It has been found that in tissue culture actively growing fibrocytes from tuberculoid skin lesions caused rapid reduction of *Myco. leprae* to acid-fast débris and the cells became damaged and changed into epithelioids. The most striking observations of this were made by adding lepra bacilli to cell cultures from such lesions when the cultures had been grown *in vitro* through many cell generations for a period of 3 months. On the other hand, fibrocytes similarly grown from lepromatous

lesions grew normally and were unable to bring about the prompt destruction of bacilli.

iii. Wade considers this last observation one of great importance, and emphasizes the need for more concentrated work in basic research. "We would suggest that in those leprosy institutions where serious laboratory work is being done, or could be done, the technique of study of macrophages in cultures should be acquired, and the reactions to the bacilli from lepromas on the part of cells from normal individuals and from patients with the different forms of leprosy should be studied, and also from patients vaccinated with BCG. And whatever line of microbiological investigation is undertaken, it would seem that closer cooperation between the laboratory investigator and the clinician is very much in order." *Ernest Muir*

Gass, H. H. & Balasubrahmanyan, M. **Changes in the Cutaneous Nerves in Leprosy.** *Internat. J. Leprosy.* New Orleans. 1954, Jan.–Mar., v. 22, No. 1, 31–40, 12 figs. on 2 pls. [17 refs.]

A study was made from biopsies from 30 patients suffering from the various forms of leprosy and in all stages of the disease. It was found that the hairs have much to do with the retention of sensation by the skin, and sensation often became absent when the part was shaved. Histological examinations of the corium at different levels showed most nerve destruction in the superficial subepithelial layer, becoming less in the deeper layers. The destruction was least in lepromatous cases and most in tuberculoids. Most of the changes found are associated with Wallerian degeneration, such as fusiform swellings and bubbles along the course of the axons, twisting, flattering and fragmentation of axis cylinders. The damage is caused not by any toxic action of the bacilli, as the changes are generally least where there are most bacilli, but by the pressure of the cellular infiltration.

In preparing material frozen sections were used, nerve fibres being stained with a modification of Bielschowsky's silver impregnation method. The condition of the nerves is well illustrated by microphotographs.

Ernest Muir

Okada, S. **Studies on Tuberculoid Visceral Leprosy. Tuberculoid Granuloma in the Liver, revealed by Puncture Biopsy.** *Internat. J. Leprosy.* New Orleans. 1954, Jan.–Mar., v. 22, No. 1, 41–6, 12 figs. on 2 pls. [14 refs.]

The author describes 5 cases in which he found tuberculoid lesions in material obtained by puncture biopsy from the liver. All the patients had annular or major tuberculoid lesions on the body surface, and in all the Mitsuda reaction was positive. In all the tuberculin test was negative, and X-ray examination showed normal lung pictures. Tests for syphilis were negative. Epithelioid cells with surrounding lymphocytes, are described: two giant cells of the Langhans type were seen in one section.

Ernest Muir

Contreras, F., Guillen, J., Tarabini, J. & Terencio, J. Elastoidosis nodular, a quistes y comedones, en la lepra. [**Nodular Elastosis in Cysts and Comedones in Leprosy**] *Rev. "Fontilles".* Valencia. 1954, July, v. 3, No. 6, 485–93, 15 figs. on 5 pls. [14 refs.]

Forty cases are described in which elastosis occurs in patients suffering from leprosy, where the appearances, clinical and histological, are similar to

the elastosis described by other authors as occurring in the atrophic skin of old people. In leprosy the condition is common when the disease is healing in lepromatous cases, especially if the patients have suffered from repeated attacks of lepra reaction, leaving the skin thin and atrophied. The condition is very well illustrated with photographs of patients and with microphotographs. *Ernest Muir*

Mut Mut, D. T. Lesiones óseas en la lepra. [**Bone Lesions in Leprosy**] *Rev. "Fontilles"*. Valencia. 1954, July, v. 3, No. 6, 505–13, 14 figs. (1 coloured) on 7 pls.

Bone lesions in leprosy are divided into specific, due to direct infection with the bacilli; and non-specific caused by neurotrophic changes in the bone, often complicated by secondary infection. In the specific form the periosteum may be infected by direct continuity from a lesion of the skin or mucosa, or the invasion may be metastatic during the occurrence of bacillaemia or septicaemia. The initial bacillary invasion is in the metaphysis of the shaft of the bone, owing to its richer blood supply and the stresses to which it is subjected. Though any of the long bones may be affected the disease is found most in the bones of the hands and feet. As elsewhere the disease begins round the blood vessels, and typical vacuolated cells are found with bacilli singly or in masses.

The most common lesions, however, are neurotrophic, and it is these that are principally responsible for deformities.

Secondary infection is liable to set up periostitis, followed by ossification which may cause considerable thickening of the cortex. The article is well illustrated with X-ray photographs. *Ernest Muir*

Contreras, F., Miguel, S., Roldan, A., Guillen, J., Terencio, J. & Tarabini, J. Proteínas plasmáticas en la lepra. [**The Plasma Proteins in Leprosy**] *Rev. "Fontilles"*. Valencia. 1954, July, v. 3, No. 6, 467–78, 9 charts.

While considerable study of changes in blood cells has been made in pathological conditions, the study of the humoral part of the blood has lagged behind because of its complexity. For the latter the cooperation of chemists and physicists with clinicians is necessary. In leprosy the changes in the plasma proteins are of great importance, and for study the electrophoretic method has been found the most convenient.

After recounting the various vital functions of the proteins the authors give in tabular form an analysis of the plasma proteins of 46 leprosy patients, comparing their percentage deviations with normal deviations. The results showed an increase of total proteins in 44·91 per cent., and a diminution in only 3 per cent. Albumin was diminished in 66·66 per cent. and increased in only 2·23 per cent. Globulin percentage changes were: *alpha 1* increase 39·02, diminution 17·07; *alpha 2* increase 69·76, diminution 9·30; *beta* increase 14·89, diminution 19·14; *gamma* increase 63·82, diminution 4·25. During lepra reaction the proportion of globulins (chiefly *alpha 2* and *gamma*) increased considerably, returning to normal at the end of reaction. When there are diffuse hepatic lesions *gamma* globulin increases most. In leprous conditions where there is a diminution of proteins the authors recommend the transfusion of blood and plasma, which they have found very efficacious. *Ernest Muir*

Buu-Hoï, N. P. **The Selection of Drugs for Chemotherapy Research in Leprosy.** *Internat. J. Leprosy.* New Orleans. 1954, Jan.–Mar., v. 22, No. 1, 16–21. [18 refs.]

There are 3 main difficulties in the way of selecting drugs for chemotherapeutic trial in leprosy: (1) inability to culture the leprosy bacillus or transmit it to experimental animals, and the different therapeutic results obtained with certain drugs in treating leprosy from those in treating other mycobacterial diseases; (2) the length of time required in treating leprosy, giving time for drug resistance and side effects; (3) the questionable ethical issue in substituting drugs of unknown effects for one of acknowledged therapeutic efficiency such as DDS. Therefore drugs should be chosen which possess 4 qualities: (1) they are tuberculostatic; (2) they are fungistatic; (3) they are of low toxicity and have little side effect, those of DDS being taken as a standard which should not be exceeded; (4) they should be capable of cheap and easy manufacture, having consideration of the poverty of most sufferers from leprosy. Two drugs are suggested as complying with these requirements: 4,4'-diaminodiphenylsulphoxide, which is less toxic than DDS; and the lipid-soluble thiocarbanilides, which, as they act differently from the sulphones, might be used in sulphone-resistant cases. *Ernest Muir*

Contreras, F., Miro, J., Guillen, J., Tarabini, J. & Terencio, J. Terapéutica de la lepra. [**The Treatment of Leprosy**] *Rev. "Fontilles".* Valencia. 1954, July, v. 3, No. 6, 495–503, 3 charts.

Since 1945 sulphones have gradually been introduced in the treatment of leprosy in Spain and now have entirely replaced chaulmoogra preparations. The authors, however, stress the importance of an adequate diet rich in proteins and vitamins, and of physical and occupational therapy.

The sulphones, thiosemicarbazones and isoniazid are discussed. Charts show the beneficial effects of modern treatment. *Ernest Muir*

Lowe, J. **The Chemotherapy of Leprosy. Late Results of Treatment with Sulphone, and with Thiosemicarbazone.** *Lancet.* 1954, Nov. 20, 1065–8. [16 refs.]

The first part of this paper dealing with the late results in leprosy with sulphone treatment is substantially the same as one already abstracted [see this *Bulletin*, 1954, v. 51, 1255]. The second half deals with thiosemicarbazone. The form used was TB1/698 (*p*-acetamidobenzaldehyde thiosemicarbazone). The number of patients treated was 273 for periods up to 38 months. The serious complications were agranulocytosis (5 cases), severe toxic anaemia (6 cases), severe hepatitis (3 cases). There were 2 deaths. During the first 2 years there was satisfactory improvement in most instances. But in the third year improvement was not so good, and many deteriorated, some rapidly. The late results were not as good as with sulphones, and in some cases there was evidence of drug resistance. Arrest of disease was produced in a smaller proportion than with sulphones, and some of these relapsed. "For these reasons, thiosemicarbazone has been abandoned for the long-term treatment of leprosy in patients who can tolerate sulphone. It remains an alternative remedy, useful temporarily for those few patients who cannot tolerate sulphones." *Ernest Muir*

Nahas, Linda, Rzeppa, H. & de Sousa Lima, L. **Blood Picture in Sulfone Treatment of Leprosy. Relation with the Dose and Blood Concentration of the Drugs.** *Internat. J. Leprosy.* New Orleans. 1954, Jan.–Mar., v. 22, No. 1, 22–30, 7 figs.

Four groups, each of 5 patients, were treated with the following drugs and dosages: (1) 0·66 gm. of the equivalent of Diasone daily, equal to 0·333 gm. of DDS; (2) 0·90 gm. of the same daily, equal to 0·555 gm. of DDS; (3) 0·2 gm. of DDS thrice weekly; (4) 0·4 gm. of DDS daily. In the first group blood concentrations of DDS varied from 0·30 mgm. per cent. to 0·45 mgm. In the second the mean concentration of DDS was 0·5, and anaemia occurred when it attained 0·7 mgm. per cent. In the third group the mean DDS blood level was 0·2 mgm. per cent. In the fourth it varied from 0·75 to 1·3 mgm. per cent.

It was found that blood concentrations of more than 0·6 mgm. per cent. caused a moderate and progressive anaemia, but that up to 0·5 mgm. did not alter the picture even on prolonged treatment. Groups 1 and 2, receiving in Diasone respectively the equivalents of 333 and 555 mgm. of DDS, showed almost the same blood concentrations, showing that there is no advantage in giving the larger amount. In group 4 the daily 400 mgm. of DDS given as such produced a mean concentration of 0·99 mgm. per cent., whereas in group 2 with Diasone equivalent to 555 mgm. of DDS the concentration was only 0·5 mgm. In the former of these 2 groups anaemia was caused in all the patients, but in the latter toxic reactions were not observed. " These data indicate, as others have observed, that the blood concentration depends more on the molecular constitution of the drug than the amount of the active substance in it." Haemoglobin determinations were held to be a safe index of optimal individual dosages. When anaemia occurred suspension of treatment was sufficient without the use of anti-anaemics. *Ernest Muir*

Rist, N., Boyer, F., Saviard, Micheline & Hamon, Viviane. Sur le mode d'action d'une sulfone thymolée argentique. [**On the Mode of Action of a Sulphone containing Thymol and Silver**] *Rev. Tuberculose.* Paris. 1954, v. 18, No. 3, 179–88, 4 figs. [12 refs.]

Rist and his colleagues in Paris studied the properties of a new disubstituted sulphone in order to investigate the claim of certain workers in leprosy and tuberculosis that it is as active as DDS yet less toxic [this *Bulletin*, 1952, v. 49, 1129; 1954, v. 51, 277]. They describe the sulphone as consisting of equal parts by weight of two compounds which they call D and A, respectively. The former is diphenylsulphone-4,4′-bisazo-*para*-isopropyl-metacresol, and the latter is the silver derivative of the same sulphone. As a result of *in vitro* tests on compound D (compound A being too insoluble) they inferred that it is virtually inactive and that any action *in vivo* would depend on its breakdown in the body to DDS. *In vivo* tests on human beings and on mice and rats showed that compound A was completely inactive, but compound D liberated one-tenth to one-twentieth its weight of DDS when optimal doses were administered by mouth. They demonstrated that the anti-streptococcal activity of 5 mgm. of compound D in mice was equal to that of 0·5 mgm. DDS, and that, owing to its poor solubility, increasing the dose of compound D did not liberate more DDS and therefore did not increase its activity. This is in sharp contrast with the soluble disubstituted sulphones and with DDS, and explains why the

new sulphone is non-toxic. Compound D had no action against tubercle bacilli in mice as it did not liberate enough DDS to be effective.

The authors conclude that the small amount of DDS liberated after ingestion of compound D accounts for the latter's activity against streptococci in mice and leprosy bacilli in man, but they doubt if it can prove as effective in human tuberculosis as less stable sulphones or DDS.

W. H. Jopling

Capurro, E. T. & Wilkinson, F. F. La hidracida del ácido cianacético en el tratamiento de la lepra. (Comunicación previa.) [**Cyanacetic Acid Hydrazide in the Treatment of Leprosy**] *Día Médico.* 1954, Aug. 19, v. 26, No. 58, 1666–7.

After reviewing recent improvements in the treatment of leprosy the authors emphasize the importance of the lead given by research in tuberculosis in indicating drugs which may profitably be tested for their action in leprosy. The drug chosen for trial was the hydrazide of cyanacetic acid. This belongs to a different group from the hydrazide of isonicotinic acid [isoniazid], as the pyridine of the latter, which is probably the toxic factor, is absent.

The trial was made in 7 patients with lepromatous leprosy. They were treated for variable periods up to a few months. The dose was 5 to 8 mgm. per kgm. of body weight given daily in tablet form. The results were flattening and either softening or absorption of leproma. No marked diminution of bacilli was noticed but there was granulation of the bacilli after the first month of treatment. Tolerance of the drug was complete. There was no lepra reaction or other complication, and in no case had the treatment to be interrupted. The authors recommend further trials of this drug either by itself or in combination with sulphones, thiosemicarbazone, etc.

Ernest Muir

Mauzé, J. La thérapie tissulaire dans le traitement de la lèpre. [**Tissue Therapy in the Treatment of Leprosy**] *Bull. Soc. Path. Exot.* 1954, v. 47, No. 4, 483–4.

The author treated 50 patients with amniotic extracts, using a 50 per cent. extract for local application in 30 of these, and injecting 4 ml. of a 10 per cent. extract intramuscularly in the other 20 twice a week. Treatment was continued for 3 years, in combination with sulphone therapy. The results were remarkable in healing up sores and perforating ulcers, and in improving the mobility of the fingers and strengthening the muscles in claw-hand. If treatment is relinquished after 3 months the condition relapses.

Ernest Muir

Rogers, L. **Progress towards the Eradication of Leprosy from the British Commonwealth.** *J. Roy. Soc. Arts.* 1954, Nov. 12, v. 102, No. 4938, 987–98, 5 figs. Discussion 998–1002.

A very thorough and well-argued account is given of the progress made toward the eradication of leprosy in the last 30 years or so. The importance of house contact in acquiring the disease is emphasized. The following plan for control of leprosy is formulated. Only infectious patients, forming usually 1 in 4 or 5 of the total, should be isolated. All contacts, especially children, should be examined at intervals, and early treatment instituted.

The results of such measures in the Southern Sudan, South Africa, South-East Nigeria, East Africa, Fiji, the West Indies, and India, are recounted, special emphasis being laid on the successful results which have been obtained in Uzuakoli in Eastern Nigeria. An account is given of the results of new forms of treatment. The importance is emphasized of prophylaxis of child contacts by treatment during the incubation period and the possible raising of their resistance through BCG vaccination.

The author concludes " . . . from recent surveys and other data I estimate that anything up to 100,000 helpless children are still becoming infected every year, quite unnecessarily, in British and Indian territories, for want of sufficient leprosaria and other accommodation for the separation of infective cases and clinics for treatment of uninfective ones.

" Early in the nineteenth century Great Britain provided £20 million sterling—now worth six times as much—to abolish slavery from our dominions. And leprosy, in the disfigurement and the life-long crippling and blindness it produces, is worse than slavery. What we now require is a modern crusade to provide the means now available to save our Empire's children from the most cruel disease that human flesh is heir to ".

Ernest Muir

[The Director of the Bureau was fortunate enough to hear Sir Leonard Rogers deliver this address at the Royal Society of Arts. It was a *tour de force* of presentation of a mass of facts and opinions, and the theme was argued with the force and wisdom characteristic of this pioneer of modern leprosy work. C.W.].

Croshaw, Betty. **The Chemotherapy of Rat Leprosy.** *J. Applied Bact.* 1954, Oct., v. 17, No. 2, 171–4. [11 refs.]

After recounting various trials of drugs that have been made for their effects on *Myco. leprae murium* [see this *Bulletin*, 1954, v. 51, 944, 1168, 1258] the author discusses his own experiments. Five different methods of inoculation and treatment are described. A suspension of ground-up nodule containing acid-fast organisms was injected: (1) in developing chick embryo; (2) subcutaneously in rats; (3) intraperitoneally in rats; (4) subcutaneously in mice; (5) intraperitoneally in mice.

The following drugs were tested: Sulphetrone, DDS, TB1, TB3, PAS, INH [isoniazid], acetone *iso*-nicotinyl hydrazone. There were also controls without bacilli, and controls with dead bacilli.

Only isoniazid and *iso*-nicotinyl hydrazone had any marked effect. " The latter drug undoubtedly acts by virtue of its breakdown to INH as shown by paper strip chromatography ". However, the effect of isoniazid against *Myco. leprae murium* infection in mice is not so great as in experimental *Myco. tuberculosis* infections. It is considered that the results of further clinical trials with isoniazid in human leprosy should be awaited before the final value of experimental *Myco. leprae murium* infections in selecting possible drugs can be assessed.

Ernest Muir

Gomez Orbaneja, J. & Garcia Perez, A. **Lepra.**

This book was reviewed in this *Bulletin*, 1954, v. 51, 1323.

HELMINTHIASIS

In this section abstracts are arranged as far as possible in the following order:—Trematodes (*schistosomes, other flukes*); Cestodes (*Diphyllobothrium, Taenia, Echinococcus, other cestodes*); Nematodes (*Hookworms, Ascaris, Filarial worms, Dracunculus, etc., Trichuris, Enterobius, Trichinella, etc.*).

Sandosham, A. A. **Malaysian Parasites II. Preliminary Note on the Incidence of Worm Infection in Common Hosts.** *Studies from Inst. Med. Res. Federation of Malaya.* 1953, No. 26, 23–8. [22 refs.]

Sri Umijati & Lie Kian Joe. Beberapa parasit jang terdapat pada binatang dan jang ditemukan pada manusia di Indonesia. II. Cestoda. [**Occurrence in Man in Indonesia of Cestodes commonly found in Animals**] *Madjalah Kedokteran Indonesia (J. Indonesian Med. Ass.).* 1953, Mar., v. 3, No. 3, 87–92. [15 refs.]

The English summary appended to the paper is as follows:—

"A review is presented of cestode parasites usually occurring in animals but some times found in man in Indonesia.

"Sparganosis was found 3 times in man. The first case was reported by von Römer in 1910 who found one sparganum in the bladder of an Indonesian naval officer. The second case was reported by Bonne in Djakarta in 1930, who found a sparganum of about 45 cm length situated in a lung-artery. The worm had caused an extensive lung infarction. In 1940 Bonne and Lie Kian Joe found 2 spargana in the wall of the small intestine of an Indonesian male who died of tuberculosis. The two larvae were fed to a kitten. Two adult tapeworms were obtained after 42 days which were identified as D. ranarum by Faust.

"Cysticercosis is also a rare occurrence in Indonesia. Until now, only one case has been reported. Hausman found 18 nodules about 18 mm in diameter situated under the skin of the back and neck and also in the tongue. The patient showed no other clinical signs.

"Hydatid disease has never been found in Indonesia, though E. granulosus does occur among dogs.

"Three species of adult animal tapeworms have been found in man.

"Bertiella studeri was found twice in man. (Joyeux and Dolfuss; Bonne.) Dipylidium caninum was found twice as a human parasite in Indonesia. (Müller.) Raillietina madagascariensis was found in a Chinese child 3½ years old. (Bonne and Mreyen.)"

Kwo Eh Hoa & Lie Kian Joe. Beberapa parasit jang terdapat pada binatang dan jang ditemukan pada manusia di Indonesia. III. Trematoda. [**Occurrence in Man in Indonesia of Trematodes commonly found in Animals**] *Madjalah Kedokteran Indonesia (J. Indonesian Med. Ass.).* 1953, Apr., v. 3, No. 4, 131–6, 13 figs. on 3 pls. [17 refs.]

The English summary appended to the paper is as follows:—

"A review is given of trematode parasites, which usually occur in animals but which have been found in man in Indonesia.

"Three cases of Haplorchis yokogawai and the same number of cases of Plagiorchis javensis have been described in man. Five species of Echinostoma have been found to infect man: E. ilocanum, E. recurvatum, E.

revolutum, E. malayanum and E. lindoensis. Two new trematode parasites, belonging to the family Lecithodendriidae, were described as occasionally being human parasites. Paralecithodendrium molenkampi had been found twice and Planeropsolus bonnei once in the small intestine of man."

Tan Kok Siang & Lie Kian Joe. Beberapa parasit jang terdapat pada binatang dan jang ditemukan pada manusia di Indonesia. IV. Nematoda. [**Occurrence in Man in Indonesia of Nematodes commonly found in Animals**] *Madjalah Kedokteran Indonesia* (*J. Indonesian Med. Ass.*). 1953, Dec., v. 3, No. 12, 487–93, 3 figs. on pl. [15 refs.]

The English summary appended to the paper is as follows:—

"A review has been given of the nematode parasites which commonly occur among animals in Indonesia and which occasionally have been found in man.

"1. Ancylostoma caninum was found once in the intestine of an Indonesian woman.

"2. Two species of the Genus Trichostrongylus have been found in man: T. colubriformis which is a common human parasite in Indonesia and T. axei which is less frequent.

"3. Oesophagostomum apiostomum was found once in an Indonesian male.

"4. Gnathostoma spinigerum was once encountered in a Chinese man who has never left Java.

"5. Ancylostoma braziliense is not a rare human parasite in Indonesia. There is since Biocca's publication some doubt on account of the identity of A. braziliense and A. ceylanicum. It is possible that the name A. braziliense used by the Indonesian authors is incorrect and should be A. ceylanicum."

Moriya, S. **The Reliability of the Current Diagnostic Methods for the Identification of Helminth Eggs.** *Parasitology.* 1954, Nov., v. 44, Nos. 3/4, 300–303, 1 fig.

Each member of a sample of N faecal specimens is examined by n smears. The following model is proposed. The N specimens are drawn at random from a population, of which a proportion $1 - \alpha$ are completely negative (containing no helminth eggs), and a proportion α are positive. Each positive specimen has a probability p of being diagnosed as positive at a single examination. An efficient method is given for estimating the unknown quantities, α and p. The method is applied to experimental data, consisting of 4 smears (each of about 0·05 gm.) from each of 143 specimens. The estimates of α, the proportion of positive specimens, were 0·42, 0·30 and 0·51, for *Ascaris lumbricoides*, hookworm, and *Trichuris trichiura*, respectively. The estimates of p, the probability of diagnosis on a single smear, were 0·83, 0·47 and 0·34, respectively. If these estimates are correct, in order to have a 99 per cent. chance of detecting a positive specimen, 3 examinations should be made for *A. lumbricoides*, 7 for hookworm, and 11 for *T. trichiura*. This standard of diagnosis is regarded as equivalent to that obtained by the acid-ether concentration technique in which 3 gm. of faeces are used. [It should be noted that, in this model, all the positive specimens are supposed to have an equal chance, p, of being correctly diagnosed. A comparison of the observed frequencies of different numbers of positive

diagnoses (Table 1) with those expected on this model, suggests that there is significant heterogenity in p. The second equation of (5) should presumably be the same as the first equation except for the interchange of $\hat{\alpha}$ and $\hat{p}$.]

P. Armitage

McCullough, F. S. & Duke, B. O. L. **Schistosomiasis in the Gambia. I. Observations on the Potential Snail Vectors of** *Schistosoma haematobium* **and** *S. mansoni*. *Ann. Trop. Med. & Parasit.* 1954, Sept., v. 48, No. 3, 277–86, 1 map & 4 figs. on pl. [15 refs.]

Few studies have been made of the snail hosts of schistosomiasis in the Gambia. During this investigation the potential vectors collected were found to be *Bulinus africanus*, *B. truncatus*, *B. forskali* and *Biomphalaria alexandrina pfeifferi*, according to the classification of Amberson and Schwarz [this *Bulletin*, 1954, v. 51, 394].

This is the most northerly area of West Africa from which *B. africanus* has been recorded. The species has a restricted distribution, being abundant in only one locality, and was found in stagnant or gently-flowing waters, both clear and polluted. *B. truncatus* distribution was similar and it tended to be more numerous though both species were often found together. Neither species was proved to transmit *Schistosoma haematobium* locally but *B. truncatus* from the Gambia was successfully infected with a local strain of *S. haematobium* in the Gold Coast. *B. forskali* (including *B. senegalensis* which is regarded as closely allied, if not identical) proved to be the most widely distributed potential vector, being ubiquitous over the eastern half of the territory and occurring focally in the western half. It is found in both seasonal and perennial collections of water including ponds which are dry for 5 or more months of the year. *S. haematobium* infection is endemic far beyond the area of distribution of the two previous snail species and in places where only *B. forskali* could be found. In these latter areas human type cercariae were found in 1 to 5 per cent. of *B. forskali* and it is believed to be the vector of urinary schistosomiasis throughout the endemic area, sometimes in association with *B. africanus* and *B. truncatus*. Wild *B. forskali* were successfully infected in the Gambia and the species has since been proved by Le Roux to transmit *S. haematobium*.

Biomphalaria a. pfeifferi was found only in 6 localities in the extreme west of the territory. It usually occurred in clear, gently-flowing, large bodies of water. *S. mansoni* infection has not been reported in the Gambia.

None of the vector snails was found in the Gambia River owing to salinity and other local conditions. They inhabited marshy areas draining into the river, laterite ponds and rice fields. It is suggested that the increasing cultivation of rice will probably result in a wider distribution and larger population of vector snails with a consequent increase in the incidence of urinary schistosomiasis.

T. H. Davey

Duke, B. O. L. & McCullough, F. S. **Schistosomiasis in the Gambia. II. The Epidemiology and Distribution of Urinary Schistosomiasis.** *Ann. Trop. Med. & Parasit.* 1954, Sept., v. 48, No. 3, 287–99, 1 map & 3 figs.

Over 1,200 persons, particularly children between 3 and 15 years, were examined for *Schistosoma haematobium* infection in 37 villages in the Gambia. The incidence was found to vary markedly from village to village.

Apart from one focus on the north bank, the West Division is free of schistosomiasis but the disease extends eastwards from the eastern part of the Central Division through most of MacCarthy Island Division, in a zone near the frontier, into the Upper River Division where infected villages are found both on and away from the river banks. Six tables give the detailed results of surveys in villages selected to throw light on the epidemiology of the disease. In villages situated near the permanent fresh-water reaches of the river and inhabited by farmers cultivating rice in adjacent swamps, the infection rates for children and adults were respectively 12·4 and 14·2 per cent. *Bulinus forskali* is present in large numbers during the rains when standing water is very abundant, but there is little tendency for people to frequent particular pools so that infection has little chance of spreading. The findings suggest that infection is rarely contracted near the villages but is acquired during travel. In contrast to the swamp villages those on the laterite plateau set back from the river show a child infection rate of 72·7 per cent. compared with 38·8 per cent. in adults. It is inferred that infection occurs seasonally in the small ponds found near every village which, apart from wells, are the only easily accessible water. They contain a large population of *B. forskali* and during the rains and until they subsequently become dry they are entered daily by the people.

In the Upper River Division where infection is distributed almost uniformly from the river to the frontier, the low ground is inaccessible during the rains owing to flooding. Only a few pools remain there in the dry season, which contain all 3 potential snail vectors and are responsible for seasonal transmission. Away from the river there are valleys between laterite outcrops which, during the rains, contain rushing flood water and in the dry season slowly moving water in which seasonal transmission may occur. On the laterite outcrops wet-season ponds exist near the villages in which transmission can only occur while they persist. In the Central and Western Divisions where the river is saline and tidal there is very little schistosomiasis. Snails are scanty and though *B. forskali* is found it is usually in water unlikely to be entered by the populace or unsuitable for transmission.

The distribution of *S. haematobium* in the Gambia is therefore determined by the local topography, transmission occurring only where there is a suitable snail host in a relatively compact body of water visited frequently by the inhabitants. Thus the incidence and transmission season varies from place to place. Probably *B. forskali* is the sole vector in the zone away from the river. Where there is a high incidence of infection the host-parasite-vector complex appears to have reached a state of equilibrium in which every child becomes infected by the age of 15 and shows certain mild symptoms locally regarded as unimportant. *T. H. Davey*

Eliakim, M. & Davies, A. M. [**The Incidence of Bilharziasis in Immigrants from Yemen, Iraq, Morocco and Iran**] *Harefuah.* Jerusalem. 1954, Sept. 15, v. 47, No. 6 [in Hebrew 121–4, 1 chart & 1 map. (21 refs.) English summary 124].

The English summary appended to the paper is as follows:—

"1. Bilharziasis in Israel became a serious medical and epidemiological problem with the recent immigration of hundreds of thousands of people from middle eastern countries.

"2. Groups of immigrants from Yemen, Iraq, Iran and Afghanistan were examined for bilharziasis by means of the skin test, the first group in

the transitional camps at Ras el Ein and Petah-Tiqva, the last three at the Petah-Tiqva camp. A group of immigrants from Morocco was examined, by the complement fixation test, immediately after their arrival in Haifa.

"3. Of 690 immigrants from Yemen, 37·9% of the males and 30·4% of the females reacted positively. The incidence of positive reactors increased with age and ranged between 21·4% in children 3–4 years old, and 84·6% in adults over the age of 50.

"4. Of 414 immigrants from Iraq, 12·2% of the males and 4·6% of the females reacted positively. The incidence of positive reactors decreased with age, from 16·7% in children 3–4 years old, to zero percent in adults over the age of 50.

"5. Of 235 immigrants from Iran, 6·7% of the males and 6·9% of the females reacted positively, the highest incidence being in the age group 20–29 years (17·6%). Three out of 48 persons from Afghanistan reacted positively.

"6. Only one of 361 sera of immigrants from Morocco gave a positive complement fixation test.

"7. The results are discussed and analysed statistically.

"8. The danger arising from the presence of egg-excretors, in transitional camps near the river Yarkon, the home of potential intermediate hosts, is stressed."

Schwetz, J. Taxonomie des planorbidae de l'Afrique éthiopienne transmetteurs des schistosomiases humaines et animales. Revue analytique. [**Taxonomy of the African Planorbidae transmitting Human and Animal Schistosomiases. Analytical Review**] *Inst. Roy. Colonial Belge. Sect. des Sci. Naturelles et Méd. Mémoires.* (Collection in–8°.) 1954, v. 25, No. 2, 49 pp. [23 refs.]

The greater part of this paper is taken up by a historical account of work on the systematics of snails transmitting schistosomiasis in Africa, and a renewed plea for the adoption of the simplified classification of planorbids proposed elsewhere by the author [this Bulletin, 1948, v. 45, 348; 1954, v. 51, 701 and 1260]. Schwetz indulges in a series of attacks on certain workers in this field, and on the policy of the World Health Organization in relation to the malacology of host snails. He again surveys factors in support of his ecological classification and summarizes that classification. His most recent work leads him to state that all forms or species of *Planorbis* and *Bulinus* are potentially transmitters of schistosomiasis.

W. Russell Hunter

Eliakim, M. & Davies, A. M. **The Complement-Fixation Test in Bilharziasis. I. The Value of Different Extracts of** *Schistosoma mansoni* **and** *Fasciola hepatica* **Worms as Antigens.** *Parasitology.* 1954, Nov., v. 44, Nos. 3/4, 407–13, 2 figs. [15 refs.]

Last year's meeting of the Expert Committee on Bilharziasis of the World Health Organization [this *Bulletin*, 1953, v. 50, 1151] stressed the fact that available methods for serological diagnosis of schistosome infections in man were not altogether satisfactory, and the present study was undertaken to compare the efficiency of antigens, obtained from *Schistosoma mansoni* and *Fasciola hepatica*, and prepared in various ways.

The positive sera of human beings were obtained from 48 proven cases of chronic schistosomiasis (37 suffering from *S. mansoni* infection, 9 from

S. haematobium and 2 from mixed infections); 24 of the patients had received no treatment, the remaining 24 had received or were receiving treatment by sodium antimonyl tartrate. The negative control sera were obtained from 60 healthy persons who had never resided in an area where schistosomiasis occurred.

In addition to the tests carried out with sera from proven human cases, sera from 3 rabbits, each of which had been "immunized" individually with worm antigen, were tested for the presence of complement fixation and for reactions to skin tests carried out with the appropriate antigens. The method used for the immunization of the rabbits is described as follows. "Three albino rabbits, weighing 2·4–2·6 kg., were immunized individually with extracts I, II and VI, a fourth rabbit serving as control." [The extracts were all prepared from *S. mansoni* worms which had been dried in the vacuum desiccator in the refrigerator, and, when dry, ground in a mortar and then preserved *in vacuo* as a dry powder. In extract I the powdered worms had been extracted in Coca's solution, in extract II in alcohol-ether and in extract VI in formamide.] "The method adopted was to give four weekly intraperitoneal injections of 0·5 ml. of 1:100 antigen dilution mixed with an equal volume of 2% sterile sodium alginate. Leaving the needle *in situ*, 0·2 ml. of sterile 2% calcium chloride was injected from a second syringe yielding an antigen depot in the gel so formed. One month later a fifth injection was given."

The author's summary is as follows:—

"1. Different extracts of adult worms of *S. mansoni* and *F. hepatica* have been examined in the C.F.T. for bilharziasis. Extracts of *S. mansoni* worms in Coca's solution, alcohol-ether and absolute alcohol after acetone extraction possess high antigenic activity, the first being the most specific but less sensitive than the others. Extracts of Coca's solution of alcohol-ether insoluble residues still showed slight activity while acetone and polysaccharide (formamide) extracts showed none.

"2. Using the Coca's extract of *S. mansoni* worms, the C.F.T. was positive in 83% of sera of untreated patients and 58% of treated. The figures using the alcohol-ether extract were 13 and 4% respectively and, for the alcoholic extract of acetone insoluble residue, 42 and 13%.

"3. Extracts of *F. hepatica* worms showed the same general trend, but even in the two extracts to show activity (alcohol-ether and alcohol extract of acetone insoluble material) the titre was too low for use in the test.

"4. Of rabbits immunized with three different fractions of *S. mansoni* worms only that given the Coca extract showed complement-fixing antibodies and then only with the homologous antigen. Skin tests on the rabbits were negative to each of the antigens used.

"5. The nature of the antigen in the C.F.T. is discussed, and it is suggested that the active portion is lipo-protein in nature or more than one substance is involved. For use in clinical diagnosis, an extract of *S. mansoni* worms in Coca's solution is recommended." *R. M. Gordon*

Davies, A. M. & Eliakim, M. **The Value of Different Antigens in the Diagnosis of Chronic Bilharziasis by the Skin and Complement Fixation Tests.** *Amer. J. Trop. Med. & Hyg.* 1954, July, v. 3, No. 4, 728–41. [24 refs.]

The authors, working in Israel, have particularly felt the need for a sure and rapid means of detection of the human schistosomal infections in view of the considerable influx of population from countries in the Middle East where schistosomiasis is endemic. After briefly reviewing previous work

on the skin and the complement-deviation tests [CFT] devised to this end, they recount in detail their own experience with some antigens for these tests. They give the following summary of their work and findings:—

" Extracts prepared from the hepatopancreas of infected snails and from adult worms of *S. mansoni* and *F. hepatica* were tested in skin and complement fixation tests on a total of 70 patients with chronic bilharziasis and 304 control subjects.

" Skin tests with a saline extract of *S. mansoni* worms diagnosed 90 per cent of the cases and yielded only 1·2 per cent ' false positives ' while for the snail liver extract, the figures were 89 per cent and 27 per cent and the *F. hepatica* extract gave 66 per cent and 11 per cent respectively. The *Schistosoma* and *Fasciola* antigens were without after effects while the snail liver extract gave rise to many late and painful reactions.

" For the complement fixation test, the *S. mansoni* extract also proved superior, diagnosing 86·5 per cent of cases of bilharziasis and being doubtful or positive in 1 per cent of controls. The snail liver antigen reacted positively with 54 per cent of patients' sera and *F. hepatica* extracts were without activity.

" When skin tests and complement fixation tests were performed together in bilharzial patients, with the snail or with the *Schistosoma* antigens, positive results were always obtained with either or both tests.

" Treatment of the chronic patients had no effect on their reaction to the skin tests with these two antigens. In the complement fixation test, no clear cut effect was observed when the *S. mansoni* antigen was used but with the snail liver extract the proportion of negative reactors was high in a group of treated patients. Individuals who were examined both before and after treatment with the *Schistosoma* antigen showed a rise of titer in the C.F.T. in some cases, a fall in others, while in the majority there was no change."

Finally they conclude that an antigen prepared from an aqueous extract of adult *Schistosoma mansoni* is effective for both the skin test and the complement-fixation test, and that it is superior to other antigens for these purposes. The tests, when performed with these antigens, are more efficacious than the usual biopsy and egg recovery technique, and should be especially useful in detecting unisexual infections [this *Bulletin*, 1949, v. 46. 268] and in those cases where few or no eggs are shed.

A. R. D. Adams

Chaffee, E. F., Bauman, P. M. & Shapilo, J. J. **Diagnosis of Schistosomiasis by Complement-Fixation.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 905–13. [13 refs.]

Antigens hitherto used in complement-fixation tests for schistosomiasis have consisted of alcoholic or saline extracts of adult worms or of the livers of snails infected with cercariae. A defect of many of these antigens has been their tendency to react with syphilitic sera, and this has been especially evident when alcoholic extracts of snail livers were employed. Taliaferro *et al.* [this *Bulletin*, 1929, v. 26, 534, 535] found that the antigen components causing false positive reactions with syphilitic sera could be removed from cercarial concentrates by organic solvents. The present authors have extended the method by extracting desiccated adult schistosomes with anhydrous ether in the cold (−15° to −18°C.) prior to final extraction with buffered salt solution, thus reducing the tendency of the antigen to react with syphilitic sera. The adult worms used were *Schistosoma mansoni* and *S. japonicum* obtained from the livers and the mesenteric and portal vessels of experimentally infected hamsters. The animals were sacrificed when

viable eggs appeared in their faeces, usually 6 to 8 weeks after infection. The details of preparation and standardization of the antigen and of performance of the test should be sought in the text of the original. Sera were obtained from 98 native Puerto Ricans infected with *S. mansoni*, the diagnosis in each case having been substantiated by the recovery of eggs. The sera were preserved by adding 0·5 mgm./ml. of dried merthiolate, and were sent by air to Washington where the serological work was done. Control sera were obtained from normal healthy members of the laboratory staff, and from syphilitic subjects giving strongly positive serological reactions. All the sera were stored at −20°C. until used, when they were thawed for 30 minutes at 56°C.

The results of the tests, with antigens made by saline extraction of untreated and also of ether-extracted adult *S. mansoni*, are summarized in a table. These two antigens were almost identical in sensitivity, 96 and 95 respectively of the 98 sera from infected persons giving positive tests with them. None of 46 healthy sera gave false positive tests, but 9 of 28 syphilitic sera gave clear, and 2 weak, positive reactions with the first antigen, the saline extract of untreated worms. None gave any reaction with the second antigen, the saline extract of ether-extracted adult *S. mansoni*.

Sera from 6 patients infected with *S. mansoni* and from 6 with *S. japonicum* were then each tested with antigens made from homologous and from heterologous adult worms; the sera could not be differentiated on the basis of their reactions to these two antigens.

The authors conclude with a discussion of sundry factors that may influence the specificity of the test, which they consider to be considerable.

A. R. D. Adams

Horstman, H. A., Jr., Chaffee, E. F. & Bauman, P. M. **Schistosomiasis mansoni in Puerto Rican Soldiers.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 914–17. [13 refs.]

Mansonian schistosomiasis is known to have been endemic in Puerto Rico at least since 1904. Various estimates and surveys of its intensity have been published; these have ranged to as high as 14·6 per cent. of some 16,000 men examined [this *Bulletin*, 1947, v. 44, 829], but the true incidence is probably much higher as in one recent study based on autopsies the incidence was shown to be 40 per cent. [*ibid.*, 1950, v. 47, 759].

A survey was made of 276 Puerto Rican soldiers in the regular army, who had all passed the usual medical entrance examination and were free from suggestive symptoms. The enquiry included a detailed history, stool examination, complement-fixation test [CFT] and an intradermal test. The CFT was performed by means of the technique and antigen advocated in the paper summarized above; the skin test was done with a 1 in 10,000 dilution of the same antigen, to which phenol had been added as a preservative, and the result was read in 20 minutes.

This enquiry showed that 18·8 per cent. of the 276 soldiers were passing *S. mansoni* ova in their stools; the sera of 43·5 per cent. of them gave a positive CFT; and 45·0 per cent. of the men gave positive intradermal tests. Detailed analyses are set out in tables; a study of these shows the CFT and the skin test to be good screening tests, which can easily be performed. Persons giving positive results with these tests do not necessarily have active infections, and so may not need treatment or constitute a public health problem. The tests merely indicate the presence of antibodies, and these may persist for years after the infection is eradicated. But these tests when positive do demand adequate stool examinations and rectal biopsy to put the matter beyond doubt.

A. R. D. Adams

Coelho, B. & Magalhães, A., Jr. Resultados patológicos de infestação experimental de *Schistosoma mansoni* em *Macaco Cebus* sp. [**Pathological Results of Experimental Infection of Species of *Cebus* with *Schistosoma mansoni***] *Publicações Avuls. Inst. Aggeu Magalhães.* Recife, Brazil. 1953, v. 2, 61–97, 26 figs. on 13 pls. [14 refs.] English summary.

Various genera and species of monkeys have been used in research on schistosomiasis, and it is well known that various species of *Macacus* are susceptible. The authors have now infected 5 monkeys of the related genus *Cebus*, from Amazonia, with a large number of cercariae of *S. mansoni*, by inducing the monkeys repeatedly to dip their hands in contaminated water to reach grains of maize or millet (*milho*) in the water. One monkey died in 30 days (after an accident); 3 died within 78 days of acute schistosomiasis with diarrhoea and anaemia, excreting many eggs; 1 was given treatment with antimony (Repodral) from the 78th day onwards for 16 days to a total of 4 ml., but died 24 days after the end of treatment.

An account is given of the lesions found; the English summary contains considerable detail and should be consulted by those who do not read the Portuguese language. *Charles Wilcocks*

Veloso, H. P. Nota preliminar sôbre um novo método de aplicação dos moluscocidas no combate à esquistossomose. [**Preliminary Note on a New Method of Application of Molluscicides for Control of Schistosomiasis**] *Publicações Avuls. Inst. Aggeu Magalhães.* Recife, Brazil. 1953, v. 2, 47–59, 9 figs. on 5 pls. English summary (9 lines).

The author notes that *Australorbis glabratus* in Minas Gerais has been found in the muddy water of marshes at depths up to 3 metres, and that it is associated with certain types of vegetation. Laboratory experiments showed that copper sulphate in a concentration of 1 in 1,000 would kill the snails immediately, and would rapidly sterilize the eggs, and that agitation of the water was important in obtaining the best results. As copper sulphate is quickly precipitated by organic matter it is important to use it in such a manner that it will act quickly, and for this reason an attempt was made to apply this principle of agitation of the water by distributing the solution from a high-pressure pump capable of producing violent agitation of the water into which the jet is directed.

The results of a field trial, in which the solution was pumped from temporary tanks, were very good. A total area of 63,157 square metres was treated in 34 days, and 150 days later no snails could be found. The cost was Cr$ [cruzeiros] 0·27 per square metre.

Photographs show the pumps in action on water, swamp and vegetation [but no exact details are given of the amount of solution used in relation to surface area or volume of water]. *Charles Wilcocks*

Magalhães Neto, B., de Moraes, J. G., de Almeida, A. M. & Calado, O. B. Fatôres que influenciam a atividade moluscocida do cobre em condições de laboratório. [**Factors affecting the Molluscicidal Activity of Copper in Laboratory Conditions**] *Publicações Avuls. Inst. Aggeu Magalhães.* Recife, Brazil. 1953, v. 2, 103–13, 6 graphs. [20 refs.] English summary (7 lines).

Copper salts may be precipitated in water which is too alkaline, or they may be adsorbed to mud; in either case their molluscicidal activity is

quickly and seriously reduced. The authors made comparative tests, in various concentrations, of copper sulphate (15–25 p.p.m.), copper acetate (4–20) and copper chloride (1·7–8·5); these concentrations represented 1·3–6·4 p.p.m. of copper. The results showed that the activity of the three compounds was about equal in equimolecular solutions.

To 100 ml. of a 0·5 per cent. [5,000 p.p.m.] solution copper sulphate were added 100 gm. of dried mud and the mixture was shaken; from 5,000 p.p.m. the concentration, as determined chemically, fell to 173 p.p.m. in 6 hours. The action of mud in natural waters, no doubt, is very variable.

It is known that copper sulphate is precipitated in alkaline water, and in another experiment tartaric acid was added to copper sulphate solution in the proportion of 8 gm. to each 5 gm. of copper sulphate, the object being to find out if the acid affected the action of the copper sulphate. Whereas with copper sulphate alone a concentration of 20 p.p.m. killed all the snails (*Australorbis glabratus*) within 24 hours, the concentration of the same salt with added tartaric acid, needed to produce the same result, was 200 p.p.m. Tartaric acid itself, therefore, strongly inhibits the action of copper sulphate. *Charles Wilcocks*

Sugiura, S., Sasaki, T., Hosaka, Y. & Ono, R. **A Study of Several Factors influencing hatching of** *Schistosoma japonicum* **Eggs.** *J. Parasitology.* 1954, Aug., v. 40, No. 4, 381–6.

The authors found that the hatching chamber and procedure developed by Stunkard [this *Bulletin*, 1947, v. 44, 432] and Ingalls *et al.* [*ibid.*, 1949, v. 46, 950], which consists of a flask supporting a vertical glass tube with a conically-bored rubber cork, effectively concentrated the negatively geotropic miracidia of *Schistosoma japonicum*. Florence and Erlenmeyer flasks were equally effective, both recovering all the miracidia from 100 eggs put into each of them. For the various experiments described the eggs of *S. japonicum* were obtained from the rabbit, goat, sheep, cow, horse, cat, dog, mouse and man.

The authors refer to earlier literature on the effects of light, temperature and *p*H of the water. They themselves record results showing that the temperature is not a critical factor under natural conditions. Hatching of the eggs occurred between 10–30°C., with a maximum range of 2–37°C. Although eggs hatched in total darkness, light caused a 60 per cent. increase in hatching. The optimum *p*H range was 5·0–8·0, the extremes being 3·0–8·6. Centrifugation of the eggs had no effect, but faecal decomposition tended to suppress hatching, as earlier workers have assumed, but the specific factor causing this effect was not determined. This observation confirms the conclusion of earlier workers that great dilution of the faeces is necessary before hatching occurs freely. Eggs from different hosts did not show significant differences of hatchability. When well-washed eggs from a goat were mixed with emulsions of the faeces of various other kinds of uninfected hosts, it was found that the rate of hatching was higher in the emulsions of the faeces of uninfected herbivorous animals (horse, cow, rabbit, goat, sheep), than in those of uninfected carnivorous or omnivorous animals. Thus the rate of hatching decreased in these emulsions in the following sequence: horse, cow, rabbit, goat, sheep, man, dog, cat and mouse. *G. Lapage*

LUTTERMOSER, G. W. **Studies on the Chemotherapy of Experimental Schistosomiasis. I. A Method for detecting Schistosomacidal Activity based on Response of *Schistosoma mansoni* Infections in Mice to Fuadin Therapy.** *J. Parasitology.* 1954, Apr., v. 40, No. 2, 130–37. [12 refs.]

A method suitable for the screening of schistosomicidal drugs is described. Mice which had been subjected to cercarial concentrations, lethal to young mice within 7 to 8 weeks, were given early treatment with the compounds under test. Active drugs prevent death of the mice by destroying the worms before they can lay large numbers of eggs and cause extensive damage to the viscera. The criteria of activity are, therefore, increased survival time of the mice, the presence of dying or dead worms in the liver and minimal liver lesions. In preliminary tests Fuadin was used to develop the technique, and the results served as a basis for a comparison of the activity of several additional compounds, including some of known chemotherapeutic value which confirmed the efficiency of the screeening techniques.

It was found that mice 4–5 weeks old, weighing about 15 gm. were the most suitable; that 22–25 cercariae per gm. body-weight comprised a lethal dose of cercariae after tail exposure; that treatment with the maximum tolerated dose of the drugs, given twice daily for 5 consecutive days, should be started 35 days after exposure; and that the period of observation should extend over 8 weeks. With each test series control groups of untreated mice and mice treated with Fuadin were established. Autopsy was made of all mice dying after treatment, and after 8 weeks the survivors were killed and examined. If numerous large schistosomes could be seen in the portal vein just before its entrance into the liver, the compound was considered to be without schistosomicidal power. The livers were examined grossly for type of lesions, a classification of which is given, and press preparations were made to determine the presence and relative numbers of living or dead worms or eggs.

Screening tests on 4 drugs which have not been reported previously showed that the activity of 9-(cyanoacetamido)-xanthene, and 1-(*p*-hydroxphenyl)-2-thiourea was of a low order. On the other hand, 9-(α-toluenesulphonamido)-xanthene showed moderate activity comparable to that of Miracil D. Mice treated with Friedheim TWSb-K [monopotassium antimony (III) α-α'-dimercaptosuccinate] showed a survival time which approximated that which obtained with Fuadin, but the percentage of dead worms in the liver was significantly lower in those treated with the former drug.

The author concludes that any compound which shows activity falling between that of Miracil D and Fuadin should be studied in detail. He outlines the determination of the therapeutic index and the further investigation of such drugs. [The author found disadvantages in 3 earlier screening techniques: see this *Bulletin*, 1948, v. 45, 620, 621; 1949, v. 46, 481; 1951, v. 48, 654; 1953, v. 50, 533.] *R. B. Griffiths*

KANT, L. & RAMA, K. **A Field Survey of *Fasciolopsis buski* in Chandrain Area of Saharsa District (Bihar).** *Indian Med Gaz.* 1954, Feb., v. 89, No. 2, 89–94.

A survey was carried out in 18 villages in an area of about 20 square miles in Saharsa District of Bihar. Annual flooding occurs over the whole area except in the villages, which during the rainy season stand out of the water as small islands; this lasts for about 4 months. The economic condition of the people is low and malaria, hookworm, kala azar and various intestinal infections are common.

A total of 3,136 persons chosen at random was given doses of tetrachlorethylene (1 drachm for an adult) and magnesium sulphate. The names of the subjects with the results of the treatment and certain other data were recorded. A total of 231 (7 per cent.) persons passed *Fasciolopsis buski* in their stools; about 60 per cent. of these required only one treatment, 6 per cent. three or four treatments. They passed from 1 to 57 worms each.

Of the symptoms and signs noted, 82 had none, 77 abdominal pain, and 57 other gastric disorders, and 92 showed marked anaemia. In all cases there was considerable improvement after treatment.

Of a total of 171, 84 per cent. showed an eosinophilia above 5 per cent., but there was no correlation between the height of the eosinophilia and the number of worms passed; the median of the curve was at the 11–15 per cent. group. [No control series was included; this percentage might well be the " normal " of the population.]

Of 3,275 snails collected in the area, 70·7 per cent. were *Viviparus variatus* and 27·3 per cent. *Indoplanorbis exustus*.

Water-chestnuts abounded in the area and these were eaten by the inhabitants as well as by pigs, both wild and domestic. Three of four wild pigs killed and examined showed *Fasciolopsis buski* in the intestines, and 11 of 16 stools from domestic pigs showed ova of this trematode.

Encysted cercariae were found in the water chestnut and on the leaves of the lotus.

[In several instances the text appears to contradict the tables; we have accepted the latter as probably being correct. A statement, " The result of treatment was verified by examination of stools of some of the positive cases at random ", suggests that in the other instances the reports of the host as to how many *Fasciolopsis* they had passed were accepted. One wonders whether in a parasite-ridden population in which an effective all-round anthelmintic had been administered such reports would be very accurate.]

L. E. Napier

Varma, A. K. **Human and Swine** *Gastrodiscoides*. *Indian J. Med. Res.* 1954, July, v. 42, No. 3, 475–9, 8 figs. on 3 pls. [10 refs.]

" Taking into consideration the significant morphological differences between the human and the swine *Gastrodiscoides*, coupled with epidemiological evidences, the author proposes to separate the latter as a variety of the former under the name *Gastrodiscoides hominis* var. *suis*, var. nov."

Kulasiri, C. **Some Cestodes of the Rat,** *Rattus rattus* **Linnaeus, of Ceylon and their Epidemiological Significance for Man.** *Parasitology*. 1954, Nov., v. 44, Nos. 3/4, 349–52. [13 refs.]

" 1. *Hymenolepis diminuta* is shown to be quite frequent in the rat, *Rattus rattus*, of Colombo; and reasons are suggested for its apparent rarity in man.

" 2. An extremely low incidence of *H. nana* in rats was found. It is suggested that this cestode will not be found to parasitize man in Ceylon as long as its murine infection continues to be low.

" 3. *Raillietina madagascariensis* is not uncommon in rats in Ceylon; but, until its vector has been detected, the possibility that it may infest man in Ceylon cannot profitably be discussed.

" 4. Instances of variation in the arrangement of genital pores in *R. madagascariensis*, and in the general anatomy of *H. diminuta* were detected."

Garcia P., Maria del C. Uncinariasis en una niña de 9 meses. [**Hookworm Infection in a Child 9 Months Old**] *Rev. Méd. Veracruzana.* 1954, Feb.-Mar.-Apr.-May, v. 35, No. 2, 2680–84.

Yamasaki, T. & Saruta, E. [**Clinical Studies on Hookworm**] *Iryo (Med. J. Nat. Hosps. & Sanatoria of Japan).* 1954, Sept., v. 8, No. 9, 31–6, 1 chart. [18 refs.] [In Japanese.]

The English summary appended to the paper is as follows:—

"Peripheral blood pictures and functions of pituitary-adrenal system (by means of Thorn's method) were examined before and after administration of vermifuges in 38 inpatients, who had no other complications than hookworm infection.

"By means of liver function test, effects of vermifuges and their secondary reactions on liver functions were also investigated.

"Results were as follows:

"(1) Subjective symptoms decreased by two or three days after administration of vermifuges, 7 days at the latest and in most cases symptoms were completely released by one month.

"(2) Since all the cases had slight anaemia, no clear relations were found between decrease of blood cells or haemoglobin, and number of worm eggs or worms in excrements. Relation between increase of eosinophile cells and number of hookworm eggs or hookworms in excrements was hardly seen, however, eosinophile cells seemed to resume their normal conditions generally six weeks after discharge of hookworms in excrements.

"(3) A low correlation was seen between reaction of occult blood and number of hookworm.

"(4) No relation was seen between pituitary-adrenal functions and number of discharged worms or worm eggs, or percentage of increased eosinophile cells.

"(5) Liver functions were generally slightly damaged and resumed normal conditions by one week after discharge of worms.

"(6) No differences in effects between tetrachloraethylen and tetren (derivative of tetrachloraethylen) were observed, however, tetrachloraethylen gave less secondary reactions against liver than tetren.

"Therefore, tetrachloraethylen may be preferable as a vermifuge. The results were concerning to Dubini hookworm cases, and further studies on Necator americanus cases are under research by the authors."

Urso, B. & Mastrandrea, G. Anchilostomiasi ed ulcera duodenale. [**Hookworm Disease and Duodenal Ulcer**] *Arch. Ital. Sci. Med. Trop. e Parassit.* 1954, Mar., v. 35, No. 3, 120–23.

Hookworm disease was first noted in Italy in 1880, during the tunnelling of the St. Gothard. There has been a considerable rise in the notification of cases in recent years and the disease has become a social health problem in the country.

Among 44 patients, the authors have found typical duodenal ulceration in 8 (18·5 per cent.), an inflammation of the duodenum or duodenitis in 12 (27 per cent.) and a lack of [?duodenal] tone in 3 (6 per cent.). X-ray examination showed an accelerated duodeno-jejunal movement in many of the patients, the test meal taking only about 1½ hours to reach the colon after ingestion.

The authors suggest various alternative explanations for the mechanism by which hookworm produces ulceration of the duodenum and they stress the importance of keeping in mind the possibility of inflammatory and ulcerating lesions of the gastro-duodenal tract in cases of hookworm disease.

J. Cauchi

Brumpt, L. C. & Ho Thi Sang. Le traitement des ankylostomoses graves par le tétrachloréthylène. [**Treatment of Severe Ankylostomiasis with Tetrachlorethylene**] *Bull. Soc. Path. Exot.* 1953, v. 46, No. 6, 1024–37. [18 refs.]

In the treatment of ankylostomiasis the view is adopted by some workers that the first essential procedure is the treatment of the anaemia; after the return of the blood picture to normal the vermifuge may be given, if it is thought necessary. This principle is satisfactory when there is only slight anaemia, but when there is severe anaemia and a heavy hookworm load it is necessary to give the anthelmintic first or a satisfactory response to the anti-anaemia treatment will not be obtained. As the patients are often very debilitated it is advisable to avoid anthelmintics such as thymol, oil of chenopodium and carbon tetrachloride on account of their toxicity on the one hand and hexylresorcinal on account of its feeble action on the other. Tetrachlorethylene is therefore the drug of choice.

The authors treated 80 patients in a hospital in North Viet Nam: of these 59 completed the course of treatment.

The clinical criteria of improvement were the "diuretic crisis" that occurred 2 or 3 days after the administration of the anthelmintic, the disappearance of the oedema that followed and the improvement in the anaemia. However, in all the patients the stools were screened and an egg count done.

Treatment was carried out as follows:—an egg count was made before the treatment. A normal midday meal was taken but after that only fluid. At midnight one hard gelatin capsule containing 1 ml. of tetrachlorethylene was taken every 5 minutes up to a total of 3 to 6 capsules. Next morning a saline purgative, of sodium or magnesium sulphate, was given. All the stools passed during the 24 hours following the purgative were collected and screened. After 10 days the stools were re-examined for eggs and, if any were found, the procedure was repeated.

The drug is well tolerated and only minor side-effects such as a slight headache, vertigo, a sense of inebriation, and somnolence, unimportant when the patient is in bed, were observed. In persons with hepatic, renal and cardiac complications, and in pregnant women, treatment was given with caution (usually 3 ml.) without ill-effects.

The results of treatment were not as spectacular as some earlier workers have reported, but this was probably because the present authors were dealing mainly with heavy infections, but they have effected the elimination of hundreds of worms even with doses of 3 ml.: they quote examples, from their tables, in which 3 ml. has produced 800 worms and 6 ml. up to 1,075 worms.

A cure rate of 50 per cent. was obtained with a single dose of 3 ml. and an 85 per cent. cure rate with 6 ml.

An advantage is that in weak patients tetrachlorethylene can be employed without a purgative.

The effect on Ascaris infection was also good; of 39 patients treated 26 were cured and in 10 the worms were partly eliminated. *L. E. Napier*

Berte, M. Les manifestations cutanéo-muqueuses des helminthiases intestinales. [**Cutaneous and Mucous Membrane Manifestations of Intestinal Helminthiasis**] *Bull. Méd. de l'Afrique-Occidentale Française.* 1953, v. 10, 199–214.

The author reports a wide variety of skin and mucous membrane changes in association with ascariasis and ankylostomiasis.

Affections of the mucous membranes included angina which might be erythematous, membranous or ulcerative and was accompanied in 5 cases out of 12 by laryngeal spasm or stridor. Other changes included stomatitis, glossitis with smooth shiny tongue, black hairy tongue, angular stomatitis resistant to vitamin B, and pyorrhoea.

Skin changes included pruritis, scarlatiniform, morbilliform, erythemato-squamous and papular eruptions. The papules might be urticarial, lichenoid, follicular or black and crusted resembling a papulo-necrotic tuberculide. Vesicular and bullous eruptions were not uncommon, the individual lesion varying in diameter from a few millimetres to 3 or 4 centimetres.

Disappearance of the rash after treatment of the helminthiasis provided evidence of a causal relationship. The diversity of the eruptions may be explained by the fact that some are toxic and others allergic phenomena.

Notes of 41 cases are contained in a summary. *H. T. H. Wilson*

Chernin, E. **Diethylcarbamazine (Hetrazan) in the Treatment of Strongyloidiasis.** *J. Parasitology.* 1954, Oct., v. 40, No. 5, Sect. 1, 589–90.

" Seven cases of strongyloidiasis among workers at a jute mill in West Bengal were treated with diethylcarbamazine (Hetrazan) in doses of 6 mgm. per kgm. of body weight 3 times daily for 6 consecutive days. Nine days after the completion of this course the stools of only 2 of the 7 were negative for *S. stercoralis* larvae, although the treatment reduced the number of larvae in the group as a whole. Toxic manifestations such as nausea, vomiting, weakness, and epigastric pain were observed in 5 of the workers treated." [See also this *Bulletin*, 1950, v. 47, 556.]

Jung, R. C. **The Predominance of Single-Brood Infections in Human Ascariasis.** *J. Parasitology.* 1954, Aug., v. 40, No. 4, 405–7. [13 refs.]

The author refers to literature which suggests that infection with *Ascaris lumbricoides* in the United States, although it does occur in adults, is primarily a disease of childhood and that children apparently infect themselves by eating dirt contaminated by *Ascaris* eggs. He set out to find out whether a large percentage of these eggs could develop on successive occasions, so that massive infections could be acquired, or whether massive infections result only from the ingestion of a large number of eggs at one time, or during a short period of time. He refers to worms derived from eggs ingested at about the same time as a " brood " of worms. Observations made by the author and Dr. Paul C. Beaver since 1947 have suggested that infection with a single brood of *Ascaris* usually occurs.

Ascaris lumbricoides were obtained from 7 patients with massive infections, either by medical treatment, or by surgical removal of worms causing intestinal obstruction, or at autopsy, and these worms were measured and their sexes were determined. As a table shows, worms of a single infection tended to be of one size, although their sizes varied considerably from patient to patient. The data thus suggested that there is a single brood of worms in the intestine of each patient, even when the infection is heavy.

This condition was also observed by Otto *et al.* (*J. Parasitology*, 1931, v. 17, 233) in one child examined by him; and Beaver [this *Bulletin*, 1953, v. 50, 229] observed that in pigs naturally infected with *A. lumbricoides*, the worms were consistently about the same size in individual pigs in all but 4 out of 71 pigs examined.

Although children pass worms spontaneously, they do not often clear the bowel of them in this way and the author thinks it probable that new larvae ingested fail to develop until the older worms are almost completely eliminated.

Sadun (*Amer. J. Hyg.*, 1948, v. 47, 282) noted the inhibitory effect on each other of successive infections of chickens with *Ascaridia galli*. He found that the host response to the second infection may drive out the first infection or interfere with the development of the second. Sprent and Chen [this *Bulletin*, 1949, v. 46, (854)] have shown that experimental infections with *Ascaris* larvae confer an immunity which tends to retain subsequent *Ascaris* infections in the liver. *G. Lapage*

Nakajima, M. **Biochemical Studies on the Nature of Ascaristoxin.** *Yokohama Med. Bull.* 1954, Feb., v. 5, No. 1, 10–20, 3 figs. [14 refs.]

Conde "Ascaristoxin" (from pig *Ascaris*) was purified by heating an aqueous solution for 30 minutes at 80°C. and precipitating the product by addition of ethanol (up to 33 per cent.) at −3°C. It was then found to be of uniform quality by electrophoresis.

Ascaristoxin appears to consist chiefly of protein, it gives a positive Shwartzman reaction in rabbits and mice and has MLD 30 mgm./kgm. (intravenously) for guineapigs. *J. H. Birkinshaw*

Halcrow, J. G. **The Vectors of Filariasis in Mauritius.** *Trans. Roy. Soc. Trop. Med. & Hyg.* 1954, Sept., v. 48, No. 5, 411–13.

This paper is an entomological supplement to a previous report on the incidence of bancroftial filariasis in Mauritius [this *Bulletin*, 1954, v. 51, 296]. Dissections of 2,456 wild *Culex fatigans* and of 1,520 wild *Anopheles gambiae* showed both species to harbour filarial larvae. The infection rates varied from 2·1 to 10·6 per cent. for *C. fatigans* and from 1·0 to 5·6 per cent. for *A. gambiae*, the lower values being for 1953, the higher for 1952. Mosquitoes with infective forms in the proboscis were less numerous than those with thoracic forms of the worm. [It is clear from the tables provided that the percentage infection rates quoted above are for developing forms in the thorax besides the proboscis stage.] It is stated that *A. funestus* was also a vector before its eradication. Although susceptible to successful infection in the laboratory [this *Bulletin*, 1937, v. 34, 459], wild *A. maculipalpis* were, on dissection, negative. Precipitin tests revealed only cattle as the host of this species. *A. coustani* rarely showed infective forms and microfilarial development was commonly inhibited severely. Neither of the last two species is considered a vector. Three specimens of *C. fatigans* out of 2,456 dissected were positive for a dirofilaria of dogs, but it is thought that the figures given for infections of this mosquito with the human parasite are not materially affected by this observation.

C. fatigans is more abundant in the coastal region than inland. *A. gambiae* is a "country" mosquito, rare in the inland plateau. It is stated that a high incidence of human filariasis on the coast is associated with low populations of *C. fatigens*, but higher densities of *A. gambiae*. In urban areas a

low incidence of human cases occurs in the presence of high densities of *C. fatigans*. [The density of *A. gambiae* in these circumstances is not stated.] There is a tendency in certain villages for human cases to be localized to groups of houses.

One gathers from rather general statements that " mosquitoes " were actively biting people out-of-doors for 2–3 hours after sunset but once the people had retired indoors to sleep no mosquitoes were found in the houses. They had taken to feeding on goats and dogs which stayed on the verandahs of the houses overnight. In precipitin tests it was found that *A. gambiae* fed twice as much on cattle as on man, but man was almost the only host for *C. fatigans*. [This paper illustrates briefly the scope of problems which arise in filariasis in Mauritius. It would seem that some of the interpretations put forward to explain the facts so briefly reported warrant further consideration based on more data. It is to be hoped that some of the problems can be dealt with further, despite the effects of the mosquito control work in recent years.] *D. S. Bertram*

Parthasarathy, T. & Kruse, C. W. **Effect of Organic Matter in the Control of *Culex fatigans* by D.D.T. Larvicide.** *Indian J. Malariology.* 1954, Mar., v. 8, No. 1, 33–43, 2 charts.

Culex fatigans, the chief vector of filariasis, has been found to thrive best in puddles polluted with sewage where 2 or 3 times the normal dose of DDT (for clean water) had failed to give satisfactory control. In an attempt to find an explanation for this, the present studies were conducted to determine the effect of organic solids on the initial toxicity of DDT used as a larvicide. All tests were conducted in the laboratory with insectary-reared *Culex fatigans*. Only larvae of early fourth or late third instar were used, in numbers varying from 10 to 160 in each replicate. Three kinds of waterproof cardboard containers were used in order to obtain the relationships of water volume to surface area to DDT dosage applied.

To determine the effect of organic solids on the growth and production of *Culex fatigans*, standard white enamel basins 7 × 12 in. were filled to a depth of 1 in. with concentrations of pea soup solutions from 8,000 p.p.m. down to tap water; 50 first instar larvae were used in each and the liquid and solid concentrations were kept constant by the addition of water to compensate for the evaporation loss. The larvae pupating each day were dried, counted and weighed for each concentration of pollution.

The results showed that the total organic solids present in the mosquito breeding place act in two ways against DDT when used as a larvicide. First, by creating suitable conditions for mosquito production and secondly, by their physical interference with the contact of the mosquito larvae with the DDT particles. The optimum pollution concentration for production of *Culex fatigans* was found to be 1,000 p.p.m. total solids. Above this value there was a definite inhibition of mosquito production. Also it has been shown that as the concentration of the solids increases, the efficiency of DDT larvicide decreases. Application of DDT larvicide on a pound per acre basis was shown to be unreliable: the dosage should be recommended on a p.p.m. or volume basis. At a dosage of 0·2 p.p.m. DDT gave satisfactory control of *Culex fatigans* in the laboratory experiments in all ranges of organic solids up to 8,000 p.p.m. This dosage could be raised to 0·5 p.p.m. to meet existing conditions in the field in the case of grossly polluted pools. Other possible causes for the ineffectiveness of DDT are discussed. *G. R. Shidrawi*

ROZEBOOM, L. E. & GILFORD, Barbara N. **The Genetic Relationships of *Aedes pseudoscutellaris* Theobald and *A. polynesiensis* Marks (Diptera: Culicidae).** *Amer. J. Hyg.* 1954, Sept., v. 60, No. 2, 117–34, 6 figs. on pl. [36 refs.]

The *Aëdes* (*Stegomyia*) *scutellaris* group of mosquitoes occurs in the Oriental and Australasian regions. In one of its 3 sub-groups (sub-group *scutellaris*) 18 species and sub-species are known. One of these, *Aëdes pseudoscutellaris*, is found only in Fiji; another, *Aëdes polynesiensis* [this *Bulletin*, 1952, v. 49, 168], also occurs in Fiji but in the following island groups as well: Samoa, Ellice, Cook, Society, Austral, Mangareva, Tuamotu and the Marquesas. *Aëdes polynesiensis* is responsible for the transmission of non periodic filariasis.

This paper includes a summary of the history of mosquito hybridization work which has been done with several species. The objects of the present investigation were to determine, through cross-breeding experiments, whether *Aëdes pseudoscutellaris* and *Aëdes polynesiensis* are genetically isolated from one another; whether mating barriers contribute toward keeping these populations from hybridizing and to obtain information about the pattern of inheritance of the morphological differentiating characters of the two populations. Materials, methods and results are discussed and the data are presented in 9 tables.

The experiments revealed that not only did the two species differ morphologically but also in a number of biological characteristics. For instance, *Aëdes polynesiensis* was easier to maintain in the laboratory and the females were more aggressive, bit more readily and lived longer under adverse conditions. *Aëdes polynesiensis* was less susceptible to infection with *Plasmodium gallinaceum* than either *Aëdes pseudoscutellaris* or *Aëdes aegypti*.

Aëdes polynesiensis and *Aëdes pseudoscutellaris* are capable of hybridization and it is probable that the hybrid populations could continue indefinitely but the members of one population will mate more readily among themselves than they will with members of the other population. Most of the hybrids were intermediate with respect to morphological characters; and the inheritance of the characters was controlled by the chromosomes. No evidence of cytoplasmic inheritance was found.

The experiments failed to reveal an effective genetic barrier. Therefore, if these forms are micro-geographically sympatric on Fiji it is difficult to understand how they can exist as specifically distinct populations unless selective mating keeps them apart. They may yet have to be relegated to some infra-sub-specific category.

Attempts at hybridization of *Aëdes polynesiensis* and *Aëdes aegypti* showed that crossbreeding can only take place with difficulty and that even if insemination were accomplished, it would probably not result in fertilization of the eggs. *H. S. Leeson*

INGRAM, R. L. **A Study of the Bionomics of *Aedes* (*Stegomyia*) *polynesiensis* Marks under Laboratory Conditions.** *Amer. J. Hyg.* 1954, Sept., v. 60, No. 2, 169–85, 2 figs. [15 refs.]

This investigation was concerned with the effect of certain environmental factors on the life-cycle of *Aëdes polynesiensis* under controlled laboratory conditions.

Previous work on other species of the sub-genus *Stegomyia* is reviewed; present methods and materials are described and results discussed; the data are summarized in 13 tables and 2 graphs. Most of the present work was done in an insectary in which the temperature ranged from 70°F. [21°C.] to 90°F. [32°C.], but was usually about 80°F. (26·5°C.]. Special studies on the effect of climatic factors were done with equipment which ensured that temperature variations were not more than ±1°F.

The eggs began to hatch 4 days after being laid, most between 5 and 8 days and then erratically for as long as 72 days. More rapid and complete hatchings occurred in waters with low dissolved oxygen content. Eggs kept at 80°F. and 95 per cent. relative humidity could survive for 2 months; at 70°F. they lived longer. If they were kept moist for 4 days and then dried at room temperature for 30 days, about 10 per cent. hatched.

In the insectary the larval period occupied 4·6 to 9·6 days and the pupal period 1·8 to 3·7 days. Some larvae were able to resist drying for 4 days and pupae for 2 days and still produce normal adults. Fourth-stage larvae could develop in 1·5 per cent. saline solution and even some first-stage larvae survived this salinity; a solution of 0·5 per cent. seemed quite harmless.

Females would feed on any animal offered (including frogs) but they preferred man. They fed from noon to late afternoon and survived 32 to 100 days. After the first blood meal the pre-oviposition period lasted 4 days; 2 or 3 days after egg-laying a second meal was taken. One female would take as many as 6 blood meals, each followed by oviposition. Between 60 and 90 eggs were laid at one time and most females laid a total of between 100 and 300 eggs; a few laid over 400.

The author sums up as follows:—"These studies show that *A. polynesiensis* is well adapted to its natural habitat. Its reproductive potential is high, and it can survive adverse conditions which would be fatal to many other mosquitoes. It is probably capable of extending its [geographical] range beyond the limits of its present distribution. It can take advantage of alterations in its environment, created by man, to build up high population densities, but appears also to be entirely capable of surviving in areas where man is absent." *H. S. Leeson*

Rachou, R. G., Lima, M. M., Neto, J. A. F. & Martins, C. M. *Aëdes scapularis*, novo transmissor comprovado da filariose bancroftiana no sul do Brasil. (Nota prévia.) [*Aëdes scapularis*, **a New Proved Vector of** *W. bancrofti* **in Southern Brazil (Preliminary Note)**] *Rev. Brasileira Malariologia*. Rio de Janeiro. 1954, Jan., v. 6, No. 1, 145.

In the course of an epidemiological survey relating to *W. bancrofti* infection in the Ponta Grossa area, Florianópolis, Santa Catarina State, Brazil, the authors caught 586 mosquitoes outside houses by means of human bait. Of these 181 were identified as *Aëdes scapularis*: 39 were dissected and 3 were found to be infected.

The authors report this as evidence of another potential extradomiciliary vector of *W. bancrofti* in Brazil and promise a fuller account of the study.
H. J. O'D. Burke-Gaffney

Stueben, E. B. **Larval Development of** *Dirofilaria immitis* (**Leidy**) **in Fleas.** *J. Parasitology*. 1954, Oct., v. 40, No. 5, Sect. 1, 580–89. [18 refs.]

Kershaw, W. E., Chalmers, T. A. & Duke, B. O. L. **Studies on the Intake of Microfilariae by their Insect Vectors, their Survival, and their Effect on the Survival of their Vectors. IV. The Survival-Rate of *Chrysops* under Laboratory Conditions, and the Effect upon it of *Loa loa*.** *Ann. Trop. Med. & Parasit.* 1954, Sept., v. 48, No. 3, 329–39, 9 figs.

The experiments were made at Kumba in the British Cameroons in the early rainy season of 1953 [see also this *Bulletin*, 1954, v. 51, 963]. Wild *Chrysops silacea* were caught before they bit fly-boys, selected for absence of microfilariae of *Loa loa* in their blood. Some of these flies were fed on persons with microfilariae of both *D. perstans* and *L. loa* and others were fed on persons with only the former in their peripheral circulation. The density of these microfilariae in the human donor was estimated. The method of keeping the flies after the infecting meal is described and illustrated. They were kept in a screened laboratory in glass jars with a leafy twig of hibiscus set in wet gravel and a wool-plug saturated with cane-sugar suspended from the gauze top of the jar. General environmental conditions were fairly stable at 80°F. and 80 per cent. relative humidity. In the original work of Connal and Connal [this *Bulletin*, 1922, v. 19, 654] the flies were offered blood meals on a guineapig every day after the infecting meal, but, in this study, only the cane sugar was provided.

The survival of the flies in relation to the densities of the microfilariae of *D. perstans* and *L. loa* in the person on which they engorged was noted and the results are presented graphically as the daily percentage survival and as a mortality rate. There are 5 graphs covering the results of the present work and 3 which treat the data of Connal and Connal in a comparable manner. The general survival curves are similar for the two groups of experiments, consisting of a smooth sweeping curve in which mortality increases with age, the logarithm of the mortality being directly proportional to the length of time the fly has been infected.

Complete development of *L. loa* in *Chrysops* requires 10 days, but in this period of time in the present work there was no evidence of an adverse effect on the fly. This confirms the observations of Connal and Connal. But it may be that these laboratory experiments would not reveal some deleterious effect on the normal functioning of the infected fly in nature, longevity and flight range being noted particularly. Attention is drawn to an observation by the present authors, who note also that a similar effect was observed in the earlier investigations of 1921: a fly harbouring infective larvae of *L. loa* seems prone to die if it ingests a blood-meal at this time. There was no evidence of microfilariae of *D. perstans* adversely affecting *Chrysops*.

D. S. Bertram

Kershaw, W. E. & Duke, B. O. L. **Studies on the Intake of Microfilariae by their Insect Vectors, their Survival, and their Effect on the Survival of their Vectors. V. The Survival of *Loa loa* in *Chrysops silacea* under Laboratory Conditions.** *Ann. Trop. Med. & Parasit.* 1954, Sept., v. 48, No. 3, 340–44, 2 figs.

This paper discusses the same experiments abstracted above but considers the survival of the *Loa loa* larvae in the flies, *Chrysops silacea*. Some flies were dissected and their intake of microfilariae was estimated; the others were not examined until they died. All the flies dissected just after the blood meal had ingested microfilariae, the numbers per fly ranging from less than about 10 to 120, with three instances of as many as 200 to 350. The number of developing larvae found increased in general with the length of time the worms had had to develop before the fly died. In some flies,

however, no earlier developing forms were seen although all flies living 10 days or more contained infective forms. It is supposed that the fact that there were flies which died early and still showed no development of the microfilariae indicated some real but obscure association between fly survival and potentiality to serve as a successful vector rather than that the observers did not see all the developing forms. There appears to be a fairly high survival rate among ingested microfilariae in their growth to the infective stage in those flies which live long enough for this development to take place.

D. S. Bertram

Mazzotti, L. Estudio comparativo entre la biopsia y la escarificación cutáneas en el diagnóstico de la oncocercosis. [**Comparison between Skin Biopsy and Scarification in the Diagnosis of Onchocerciasis**] *Rev. Inst. Salubridad y Enfermedades Trop.* Mexico. 1954, Mar., v. 14, No. 1, 19–23. [11 refs.]

The English summary appended to the paper is as follows:—

"Studies on the comparative efficiency of cutaneous biopsy and scarification were made on 100 onchocercal patients.

"In 94% of the cases the cutaneous biopsy gave positive results while on the same individuals scarification was positive in 82%.

"It is concluded that biopsy gives better results than scarification although in special circumstances this last method may have some advantage."

Aquadro, C. F. **Cryptitis with Pinworm Infestation.** *U.S. Armed Forces Med. J.* 1954, Aug., v. 5, No. 8, 1209–12.

A 20-year-old man complained of intermittent attacks of excessive sweating and a burning sensation in the anal region, an occasional brown watery staining of his underclothes associated with blood-streaking of the toilet paper, and formication in the anal region after the passage of a motion. He had had these attacks for 2 years, but during the last 6 months they had increased in intensity and frequency.

Proctoscopic examination showed hypertrophied anal papillae and small internal haemorrhoids. All other examinations, including blood counts, failed to reveal any abnormality.

Haemorrhoidectomy and cryptectomy were performed and two threadworms (pinworms; *Enterobius vermicularis*) were found in one of the crypts of Morgagni. Further crypts were excised but no more worms were found.

No ova were found in the stools or by the cellulose-tape method. Treatment by gentian violet was given, but no follow-up report was obtained.

L. E. Napier

Kendig, E. L., Jr. & Arnold, G. G. **Oxytetracycline in the Treatment of Pinworm Infestation.** *Antibiotics & Chemotherapy.* New York. 1954, Oct., v. 4, No. 10, 1111–12.

"Seventy-two per cent of 54 patients with pinworm infestation responded to oxytetracycline therapy, 5 mg. per pound per day, after treatment for one week. Ten mg. of oxytetracycline per pound per day for three days was essentially ineffective therapy (25 per cent. cure). Three negative cellulose tape smears at one, two, and three weeks after treatment used in this study seems a good criterion for cure, since the life cycle of the pinworm may vary from 14 days to two months."

DEFICIENCY DISEASES

DE WET, J. S. DU T. **The Association of Undernutrition and Psychosis.** *South African J. Clin. Sci.* Cape Town. (Incorporating *Clin. Proc.*) 1954, June, v. 5, No. 2, 97–107. [15 refs.]

The author has studied 142 African female patients admitted to a mental hospital in one year. Of these, 52 had signs of undernutrition. To what extent was the undernutrition the cause of the psychosis or secondary to it? This is the question asked. In an attempt to provide an answer the author drew up an " organic-reaction syndrome rating " based on an assessment of the severity of three prominent mental features — confusion, emotional instability and visual hallucinations. An " undernutrition rating " was also given to each patient based on the severity of 13 signs of undernutrition. A statistical attempt was then made to correlate mental and nutritional states. Between the psychosis and the undernutrition there was a high degree of correlation, but as the conditions were for the most part mild, " this correlation is perhaps not very significant." Clearly the author cannot answer his question. However, it is a good question and others will be interested to read in more detail about his very worthwhile attempt. *R. Passmore*

SUBRAHMANYAN, V., REDDY, S. K., MOORJANI, M. N., SUR, G., DORAISWAMY, T. R., SANKARAN, A. N., BHATIA, D. S. & SWAMINATHAN, M. **Supplementary Value of Vegetable-Milk Curds in the Diet of Children.** *Brit. J. Nutrition.* 1954, v. 8, No. 4, 348–52. [14 refs.]

" 1. A feeding experiment extending over a period of 6 months was carried out on forty-two girls aged between 4 and 11 years in a boarding home in Mysore to assess the value of adding a supplement of vegetable-milk curd to the diet.

" 2. Data regarding the weight, height, nutritional status, haemoglobin level and R.B.C. count were obtained at the beginning and the end of the experiment for children in the control and in the experimental groups.

" 3. The results of statistical analysis showed a significant improvement in the weight, height and nutritional status of children receiving the supplement of vegetable-milk curd over those in the control group."

WALKER, A. R. P. & ARVIDSSON, U. B. **Fat Intake, Serum Cholesterol Concentration, and Atherosclerosis in the South African Bantu. Part I. Low Fat Intake and the Age Trend of Serum Cholesterol Concentration in the South African Bantu.** *J. Clin. Investigation.* 1954, Oct., v. 33, No. 10, 1358–65. [44 refs.]

" 1. The South African Bantu, in common with most indigenous populations dwelling in tropical and semi-tropical regions, are habituated to a diet, *inter alia*, of low fat content, averaging less than half of that consumed in the United States.

" 2. The age trend of serum cholesterol has been investigated in 218 urban Bantu subjects, of ages ranging from 15 to 93 years. Up to 40 years, the differences between mean values obtained among the Bantu and in Minnesota (Keys and his associates), are not significant; thereafter, the Bantu data are significantly lower ($P<0{\cdot}01$). The regression curves of the Bantu and Minnesota data for the group from 17 to 45 years differ significantly in slope ($P<0{\cdot}05$).

" 3. Groups of rural Bantu from other territories likewise accustomed to a low fat intake, and in a good state of health, were also found to have low mean cholesterol values.

" 4. Urban Bantu consuming a Europeanized diet with an increased fat intake have a significantly higher mean serum cholesterol concentration than corresponding groups of rural (though not urban) Bantu eating their usual diet with its low fat content ($P < 0{\cdot}05$).

" 5. Discussion of the relevant evidence suggests that racial differences, state of health, caloric deficiency, low cholesterol intake, and pathology and dysfunction of liver and pancreas bear little responsibility for the low serum cholesterol values observed.

" 6. The main dietary influencing factor may well be the habitually low fat intake of these people. Impressions suggest, however, that further dietary factor or factors are implicated, possibly related to the high ' residue ' diet of these people."

Higginson, J. & Pepler, W. J. **Fat Intake, Serum Cholesterol Concentration, and Atherosclerosis in the South African Bantu. Part II. Atherosclerosis and Coronary Artery Disease.** *J. Clin. Investigation.* 1954, Oct., v. 33, No. 10, 1366–71. [25 refs.]

" An examination of post-mortem material at Baragwanath Non-European Hospital shows that severe atherosclerosis and coronary artery disease are less common among Bantu patients attending this hospital than in American and Danish hospital populations.

" Some of the possible aetiological factors causing this lower incidence of atherosclerosis have been briefly mentioned. Attention is drawn to the low level of serum cholesterol among out-patients and in-patients attending this hospital reported in the first part of this study (25). These observations are in accord with the belief that populations with a low serum cholesterol tend to have a lower incidence of severe atherosclerosis."

Linhard, J., Busson, F., Trapet, P., Giraud, P., Lecocq, F. & Guyonnet, C. Variation de la protéinémie sérique relative chez l'Africain de Dakar au cours de l'année. [**Variation in Relative Serum Protein in Africans at Dakar in the Course of the Year**] *Méd. Trop.* Marseilles. 1953, July–Aug., v. 13, No. 4, 530–33, 1 graph.

In continuation of previous work [this *Bulletin*, 1953, v. 50, 840] the variation in total serum protein was determined throughout one year in Europeans and Africans at Dakar. The serum protein of the European (calculated mean 78·7 gm. per 1,000 ml.) was always below that of the African (82·6 per 1,000). The variations in the two curves show a remarkable parallelism. There was a sharp fall in serum protein in June, at the beginning of the hot moist season, then the protein concentration increased regularly until the end of the year (beginning of the cold season). In January the protein fell to a relatively low value, which was maintained until May. Low values recorded in December are considered to be an anomaly for the particular year (1952). *J. H. Birkinshaw*

Mukherjee, K. L. & Werner, G. **Enzyme Activity and Protein Concentration in the Serum of Patients with Malnutrition.** *J. Lab. & Clin. Med.* 1954, May, v. 43, No. 5, 727–31, 1 fig. [21 refs.]

The amylase and lipase activity of 28 samples of serum from 15 patients was investigated. There was a correlation between serum amylase (33 to

261 Smith-Roe units) and serum albumin (1·1 to 4·5 gm./100 ml.). Levels of serum albumin and serum amylase rose together during treatment till the serum albumin reached 2·5 gm./100 ml., but with higher values of serum albumin there was no further rise in amylase activity. In these patients, malnutrition did not lead to a reduction in serum lipase below control levels (except in one instance). *R. Passmore*

GYÖRGY, P. **On Some Aspects of Protein Nutrition.** *Amer. J. Clin. Nutrition.* 1954, July–Aug., v. 2, No. 4, 231–42. [27 refs.]

This is the script of a lecture given to the American Society for Biological Research. A wide field is covered concisely but critically, and it is impossible to abstract the whole. Indeed, readers of this *Bulletin* will already be familiar with much of its contents. Of particular interest is Professor György's account of his own investigations into the nutritive properties of human milk. It is now generally realized that a proportional rather than an absolute statement of dietary protein requirements is desirable. Field studies indicate that, if less than 10 per cent. of the total calories in a diet come from protein, there is danger of clinical manifestations of protein deficiency. However, human milk provides an important exception to this generalization. Although an ideal food, the ratio of calories from protein to total calories is only 6 to 7 per cent. No conclusive evidence has been produced that the amino-acid composition or the better digestibility can account for the superiority of human milk as a source of protein.

György has shown that human milk possesses a growth-promoting factor for a special strain of *Lactobacillus bifidus*, which factor is not present in cow's milk. It has not been identified chemically, but is associated with nitrogen-containing polysaccharides with high hexosamine content. The factor is also present in hog mucin, and when this is added to cow's milk, suitably diluted, it has proved to have growth-promoting effects on rats. It is too early to assess either the biological or the clinical significance of this discovery, but the demonstration of a new nutrient factor in human milk is clearly of great interest and may help to explain the apparent anomaly of the superior properties of human milk proteins.

R. Passmore

MACDOUGALL, Lorna G. **Kwashiorkor Syndrome in a 3-Months-Old African Infant.** [Memoranda.] *Brit. Med. J.* 1954, Nov. 13, 1150.

Kwashiorkor is apparently rare below the age of 6 months [this *Bulletin*, 1953, v. 50, 141], and between 4 and 6 months it is usually seen in cases where breast feeding has been replaced by starchy foods from birth.

The author, from Kenya, records the case of a premature Jaluo baby aged 3 months who had been breast fed from birth and apparently thrived, but from the age of 1 month onwards developed marked oedema of the extremities, loose stools, pale and depigmented skin and white hair. There was no loss of subcutaneous fat, but the liver was enlarged. The plasma proteins were reduced. There was no history of infection or other illness.

Breast feeding was maintained and supplemented with 8 gm. of protein daily in the form of skimmed milk. No improvement occurred and although tube feeding, expressed breast milk and skimmed milk produced temporary improvement, the child developed pneumonia and died within 48 hours, despite penicillin therapy, 3 weeks after admission. At autopsy a generalized fatty change was found in the liver, without cirrhosis, and the pancreas showed some atrophy and cirrhosis. *H. J. O'D. Burke-Gaffney*

Lipparoni, E. Il kwashiorkor nella zona del Medio Uebi Scebeli. [**Kwashiorkor in the Uebi Scebeli Area, Somalia**] *Arch. Ital. Sci. Med. Trop. e Parassit.* 1954, Aug., v. 35, No. 8, 379–97. [21 refs.]

The English summary appended to the paper is as follows:—

"The author gives a brief account of the notions gathered by the experts of the W.H.O. and the F.A.O. in several African regions on the problems aroused by kwashiorkor. The pathological causes of the syndrome are not well known. In Somalia, where the alimentary diet of the population is normally rich in proteins (especially milk proteins) the problem connected with the weaning of babies does not exist; only in exceptional circumstances, such as scarcity of food, the author has found among the children of the rural areas, where he is working, cases of the kwashiorkor syndrome. These cases, though limited in number, are not to be overlooked.

"The author gives the clinical picture of the disease, as he had the opportunity to observe it, and he discusses some dubious features of the syndrome, as depigmentation and dermatosis. He believes that kwashiorkor might be considered as non-existent among the populations of the Medium Uebi Scebeli as long as alimentary conditions are normal; but, as soon as food scarcity sets in for a longer period, the disease might spread among the children of rural areas."

Food and Agriculture Organization of the United Nations. FAO Nutritional Studies No. 13. **Síndrome policarencial infantil (Kwashiorkor) and its Prevention in Central America** [Autret, M. & Behar, M.]. pp. vi + 81, 8 charts & 11 figs. (4 coloured) on 6 pls. [108 refs.] Rome: 1954, Oct. [$1.00; 5s.]

Autret and Brock after an extensive tour of Africa concluded in their monograph *Kwashiorkor in Africa* [this *Bulletin*, 1952, v. 49, 988] that nutritional disorders described under a great variety of names in many parts of Africa were all essentially the same as the disease originally described in the Gold Coast and there called kwashiorkor. Now after a visit to 5 countries in Central America, Autret and Behar conclude that the condition known in Latin America as *síndrome policarencial infantil* is identical clinically and epidemiologically with kwashiorkor. This monograph gives a concise account of the clinical features with excellent photographs, of the treatment and of the dietary factors leading up to the disorder and their prevention. An insufficiency of dietary protein, especially in the period just after weaning, is the primary cause. The details of the dietary habits and of possible preventive measures naturally differ from those in Africa. Otherwise this report is essentially the same as the African study. It is also available in French (*Bull. World Health Organization*, 1954, v. 11, November–December). The English edition is a model exposition of clear and concise scientific writing. The report will be of great practical value to all concerned with the health of the people of Central America. *R. Passmore*

Payet, M., Camain, R. & Pene, P. Place des stéatoses dans les cirrhoses dites-nutritionnelles des Africains adultes à Dakar, à propos de cinquante cas de cirrhoses. [**The Rôle of Fatty Degeneration in so-called Nutritional Cirrhosis of the Liver in African Adults at Dakar, a Study of 50 Cases**] *Bull. Méd. de l'Afrique-Occidentale Française.* 1953, v. 10, 89–96. [32 refs.]

In each of the 50 cases, a precise aetiology appeared to be present. Virus hepatitis, present in 19 cases, was the most common. Bacterial, protozoal

and helminth infections were also responsible. Fatty infiltration was exceptional and only marked in two cases, the only two Europeans in the series, who were both alcoholics. The diet of the majority of the Africans appeared to have been satisfactory and to have contained a sufficiency of protein. The authors state that it appeared to be impossible to associate these cirrhoses as a distant consequence of histological changes in the liver, arising in the course of kwashiorkor in childhood. [Most of the histological studies appear to have been done on biopsy material. Unfortunately the clinical data are only presented in outline and not closely correlated with the histological data. This absence of detail detracts from the value of what would otherwise appear to be an important paper.] *R. Passmore*

Lie Kian Joe & Sutomo Tjokronegoro. Fibrosis atau cirrhosis hati pada anak di Djakarta. [**Liver Fibrosis or Cirrhosis in Children in Djakarta**] *Madjalah Kedokteran Indonesia (J. Indonesian Med. Ass.).* 1954, Jan.–Feb., v. 4, Nos. 1/2, 7–25, 33 figs. on 17 pls. [17 refs.]

The English summary appended to the paper is as follows:—

" (1) Liver fibrosis or cirrhosis is frequently found in children in Djakarta, with or without malignant malnutrition. However, serial biopsies of the liver done in 22 children with malignant malnutrition, either during the recovery stage or when they were readmitted for a relapse, with an observation period of many months, did not show a definite increase of fibrous tissue. This suggests that if malnutrition does cause fibrosis of the liver, it does so very slowly.

" (2) Apparently marked fibrosis in young children is not likely to be the result of deficient nutrition alone. There must be other factors apart from malnutrition which cause a rapid proliferation of fibrous tissue in the liver. It is suggested that a disease which is consistent with viral hepatitis which is frequent both in children and adults in Djakarta might be one of the causative factors.

" (3) Severe fatty infiltration is often observed in children with malignant malnutrition; it heals without concomitant proliferation of connective tissue."

Lie Kian Joe & Sutomo Tjokronegoro. **Hepatic Fibrosis or Cirrhosis in Children in Djakarta.** *Documenta Med. Geograph. et Trop.* Amsterdam. 1954, Sept., v. 6, No. 3, 193–207, 6 figs. [11 refs.]

This paper is based on a study of needle biopsies from the livers of children in a Djakarta hospital. Of 57 children without signs of malnutrition, the liver showed evidence of slight fibrosis in 17 and moderate or marked fibrosis in 11, and the authors conclude that the condition is common. Of 104 children with signs of malnutrition associated with protein deficiency (kwashiorkor), the liver showed evidence of slight fibrosis in 48 and moderate or marked fibrosis in 16. Serial biopsies in some children during convalescence or a relapse showed no increase in fibrous tissue. Severe fatty infiltration was often observed in children with malignant malnutrition, but it healed without concomitant proliferation of connective tissue. The authors conclude that severe fibrosis in young children is not likely to be the result of protein deficiency alone. Other factors must be responsible and it is suggested that viral hepatitis, which is frequently seen in Djakarta, may be one of these.

[This clear distinction between the origin of fatty livers and fibrotic livers in so many Indonesian children is an important observation. This paper will be read with interest in Jamaica, where a similar distinction is being made. At the time of writing the authors were unfamiliar with the epidemiological studies of Waterlow [this *Bulletin*, 1955, v. 52, 75] or the histological studies of Bras, Jelliffe and Stuart [*ibid.*, 1954, v. 51, 972 and 973]. Neither the text nor the microphotographs show any evidence of an obliterating endophlebitis of the hepatic veins. No reference is made to either malaria or a toxic agent in bush teas as possible factors causing the fibrosis.] *R. Passmore*

SPRUE

Lindner, E. Elektronenmikroskopische Untersuchung von braunen fluoreszierenden Pigmenten bei Vitamin-E-Mangel. [**Electron Microscopic Study of the Brown Fluorescent Pigment in Vitamin E Deficiency**] *Ärztl. Forschung.* 1954, Nov. 10, v. 8, No. 11, I/505–I/513, 4 figs. on 2 pls. [51 refs.]

The English summary appended to the paper is as follows:—

"Extracted pigment from the uteri of vitamin-E deficient rats, and a similar pigment with the same histochemical and staining properties from the small intestine of a case of sprue, were studied by fluorescence and electron microscopy. The vitamin-E-deficiency pigment, which gave yellow-brown fluorescence was characterised as a polydisperse globular colloid. Solutions formed films or globular particles on drying. Primary particles could not be resolved by the electron microscope used, and are believed to be smaller than 4 mμ. Electron diffraction diagrams showed diffuse rings. The sprue pigment consisted of irregular rather large particles. By reprecipitation it was shown to be similar to the vitamin-E-deficiency pigment of rats in all properties tested. A vitamin-E-deficiency in human sprue may be considered, but cannot be fully proved."

HAEMATOLOGY

Chernoff, A. I., Minnich, Virginia & Chongchareonsuk, S. **Hemoglobin E, a Hereditary Abnormality of Human Hemoglobin.** *Science.* 1954, Oct. 15, v. 120, 605–6, 1 fig. [11 refs.]

In an investigation of Thai patients an abnormal haemoglobin was detected which differed in its electrophoretic properties from others known before (A, C, D, S and F). At about the same time Itano, Bergren and Sturgeon (*J. Amer. Chem. Soc.*, 1954, v. 76, 2278) identified an abnormal haemoglobin which they called haemoglobin E, in a child with an atypical anaemia. A sample of blood from one of the Thai subjects was compared with that of the child and the two haemoglobins were found to be electrophoretically identical. Thus the haemoglobin found in 8 Thai subjects was haemoglobin E. Eluates of pure haemoglobin E from filter paper were examined spectrophotometrically and no deviation from the curve of normal

adult haemoglobin was detected in the visible range. Two conditions with haemoglobin E were noted: (1) haemoglobin E trait in which haemoglobin A and haemoglobin E were present, and (2) Mediterranean-haemoglobin-E disease, in which no haemoglobin A was present and haemoglobin E was combined with haemoglobin F. *H. Lehmann*

Terry, D. W., Motulsky, A. G. & Rath, C. E. **Homozygous Hemoglobin C. A New Hereditary Hemolytic Disease.** *New England J. of Med.* 1954, Sept. 2, v. 251, No. 10, 365–73, 11 figs. [31 refs.]

Of the various human haemoglobins, A, S and C have been found in the homozygous condition. AA is the combination seen normally, SS is found in sickle-cell anaemia, and the authors mention the finding of CC by 3 groups of North American workers besides themselves. [CC has also been reported from the Gold Coast (this *Bulletin*, 1954, v. 51, 1188) and EE has been described—at about the time this paper appeared—from Thailand.] This report concerns itself with a detailed study of a patient with homozygous haemoglobin C. The differential diagnosis of this mildly haemolytic condition is discussed, and, as 13 relatives were available, a valuable genetic study could be made. An interesting technical detail was that the red-cell survival time measured by tagging the cells with radio-active chromium was nearly normal, but on determination with Ashby's technique (transfusion of the patient's cells into another person) was found to be definitely below normal. Normal blood transfused into the patient had a normal survival time. Its presence was shown and its amount was measured by paper electrophoresis. The transfused A haemoglobin was separated from the patient's haemoglobin C on paper and the percentage of A and C was determined by scanning the paper strip with a photo-electric cell attached to a galvanometer. *H. Lehmann*

Lie-Injo Luan Eng. **False Positive Tests for Sickling of the Blood.** *Documenta Med. Geograph. et Trop.* Amsterdam. 1953, Sept., v. 5, No. 3, 266–70, 2 figs. [15 refs.]

Hahn and Gillespie [this *Bulletin*, 1928, v. 25, 387] discovered in 1927 that sickling occurred only when susceptible cells contained haemoglobin in its reduced form. There are 3 types of procedure for producing sickle cells: addition to blood of a reducing agent such as sodium metabisulphite, admixture of oxygen-consuming organisms such as bacteria or yeast, and simple incubation of a sealed specimen where one relies on the oxygen utilization of the white cells. The author has found that a positive result obtained with the last technique—the moist stasis method—does not always mean that the cells contain sickle-cell haemoglobin. In a number of normal blood samples sickle cells were seen when glass slides from a certain batch were used. The substance adhering to the slides which must have been responsible could not always be removed by the conventional methods of cleaning. [Some of the cells reproduced in one of the two illustrations have in fact the features of true sickle cells, *i.e.*, the curvature and the irregular spines which differentiate the true sickle cell from cells elongated because of an external stress such as slow drying of surrounding plasma. Obviously the slides must have a substance upon them which favours intracellular crystallization of normal haemoglobin, a phenomenon usually seen only with reduced sickle-cell haemoglobin. One is reminded of the specific effect of zinc on the crystallization of insulin. For practical purposes filter-paper electrophoresis and

solubility studies will always decide whether or not cells are true sickle cells in the chemical sense of the word.] *H. Lehmann*

Raper, A. B. **Sickling and Malaria.** [Correspondence.] *Brit. Med. J.* 1954, Nov. 13, 1162–3.

Moore, Brass and Foy [this *Bulletin*, 1954, v. 51, 1221] have challenged the hypothesis of Allison [*ibid.*, 526] who brought forward evidence that the sickle-cell trait protected against malaria. Allison used variations in sickling rates in different places to show that the degree of malarial endemicity determined to some extent the frequency of the sickle-cell gene [*ibid.*, 1143]. Moore *et al.* showed that two neighbouring peoples with widely differing sickling rates had a similar incidence of malarial parasitaemia. The present letter points out that gross parasite rates can be equal in two communities, yet malaria may be eliminating the non-sicklers more rapidly in one than in the other. To exclude this possibility the degree of parasitaemia in the two populations should be taken into consideration. " Life is only endangered when the count is high, hence no assessment of the selective effect of malaria is valid unless this factor of severity is taken into account.

The author has found in 1,200 children under 10 presenting for any reason at Kampala hospital that 73 out of 191 sicklers and 494 out of 1,009 non-sicklers were infected with *P. falciparum*, a difference in favour of the sicklers for which the $\chi^2 = 7{\cdot}39$ for 1 d.f. Very large numbers have to be examined before the difference becomes apparent at an acceptable level. " It is therefore not surprising, in the much smaller series of Foy and his colleagues, of mixed adults and children, undifferentiated either by natural or numerical measures of severity of malaria, that no apparent difference emerges." [It is only fair to Moore, Brass and Foy to point out that Allison himself did not employ the criteria brought forward by Raper. Their aim was to prove or disprove Allison's work by a parallel investigation, and they could not therefore be expected to be more stringent than Allison himself.] *H. Lehmann*

VENOMS AND ANTIVENENES

Lee, Ya-pin. **Effects of Snake Venoms on Diphosphopyridine Nucleotide-Cytochrome *c* Reductase and Cytochrome *c* Oxidase.** *J. Formosan Med. Ass.* 1954, June, v. 53, No. 6, 361–7, 4 figs. [15 refs.]

Huang, Po-chao. **Prevention and Reversal of Succinate-Cytochrome *c* Reductase Inhibition caused by Cobra Venom.** *J. Formosan Med. Ass.* 1954, June, v. 53, No. 6, 353–9, 3 figs. [18 refs.]

Kuwajima, Y. **Immunological Researches on the Main Formosan Poisonous Snakes, especially on the Venoms. 5. Therapeutic Experiment of Mice injected with the Snake Venom by means of the Antivenin Serum.** *Japanese J. Exper. Med.* 1953, Oct., v. 23, No. 5, 457–64.

TOXOPLASMOSIS

United States Public Health Service Publication No. 247. **A Bibliography of Toxoplasmosis and** *Toxoplasma gondii* [Eyles, D. E. & Frenkel, J. K.]. pp. iv + 47. 1952. Washington: U.S. Govt. Printing Office. [20 cents.]

This bibliography contains a list of 920 references to papers on toxoplasmosis up to 1952, listed alphabetically by author. The bibliography is not annotated. In some cases, abstract references (including some in this *Bulletin*) have been included as well as the original citation.

With the increasing interest in toxoplasmosis, this painstaking collection of references by recognized authorities will prove very valuable to those engaged in studying the disease. *H. J. O'D. Burke-Gaffney*

Wildführ, G. [Edited by], with the assistance of N. Aresin, H. Essbach, H. Hudemann, F. Müller & J. Dittrich. Toxoplasmose. Forschungs- und Untersuchungsergebnisse aus den Leipziger Universitätskliniken und-Instituten. [**Toxoplasmosis. Studies undertaken in the Leipzig University Clinic and Institute**] 176 pp., 82 figs. 1954. Jena: Gustav Fischer, Villengang 2. [DM 18.]

The Professor of Hygiene and Bacteriology of the University of Leipzig has assembled a suitable team of clinicians, ophthalmologists and morbid anatomists to collaborate with him in producing a monograph on toxoplasmosis. The basic knowledge we have of this interesting condition is presented clearly and is used as a background against which to set out the author's own research observations.

The first 5 chapters of this book are a general review of our knowledge of the condition, toxoplasmosis in infancy, in childhood and in the eye, and an account of the pathological anatomy of the condition. The remaining 3 chapters are concerned with the laboratory methods of diagnosis, a critical examination of the relationship between 8 different strains isolated from clinical cases and an experimental consideration of transplacental infection in gravid animals. These last three chapters, appropriately, are mainly by Professor Wildführ.

Of the clinical and anatomical aspects of toxoplasmosis little new is said although the subjects are exhaustively discussed and elegantly illustrated from the authors' own cases. The serological investigation of toxoplasmosis is dealt with mainly from the standpoint of toxoplasma isolation and the Sabin and Feldman dye test. Very full details are given in tables of 44 cases in which toxoplasms were isolated by animal inoculation, 39 times from the cerebrospinal fluid, 4 times from material from the eye and once from the placenta. Mice and hamsters were used and it is interesting that many passages before demonstration of toxoplasms were generally not necessary, toxoplasms being demonstrated often on the first passage and sometimes on the second passage; only occasionally was a third passage necessary. Full consideration is given to the dye test of Sabin and Feldman and the toxoplasmin skin test is briefly described. Interesting details are given of the experimental infection of rats with toxoplasms and the serological findings in the infected animals' descendants.

Many will be surprised at the reliance placed on what seem to be very low dye test titres. Sabin and Feldman originally stated that the dye test was positive when 50 per cent. or more toxoplasms in mouse peritoneal

exudate were modified by antibody, and in the stronger dilutions of suspect serum it is the usual experience that practically 100 per cent. of toxoplasms are unstained. Professor Wildführ's serological findings never appear to be as clear-cut as this and between dilutions of 1 in 5 and 1 in 50 the percentage of toxoplasms unstained may vary as little as from 72 per cent. to 48 per cent.; such a narrow variation around the 50 per cent. mark must give rise to enormous experimental error. [It would suggest to the reviewer that trouble was being had with the donor suspending serum.] While the titres running into thousands originally described by Sabin and Feldman are seldom encountered in routine practice, yet titres obtained in proven cases in Britain are usually much higher than those described in this monograph. This point is noted by the author, who thinks that his lower titres are due to details of technique. The well known non-specificity of the dye test is considered briefly, and as no corroborative test is being employed it is surprising that more weight is not given to this possible source of diagnostic error. Contrary to general laboratory practice the complement-fixation test is not employed, although the Westphal antigen is presumably available, or can readily be made by any laboratory undertaking tests for toxoplasmosis. The author's undoubted success in isolated toxoplasms from his clinical cases perhaps enables him to dispense with such procedures as the complement-fixation test.

To all who are interested in the subject of toxoplasmosis—and this must be a rapidly growing number—and for those who can read German, this monograph will be an excellent starting point as well as reference book, and the large number of successful isolations of the parasite makes the disease entity more real than the mere reporting of positive serological findings ever can. It is perhaps a little unnecessary to include the 9 closely printed pages of references, as a complete bibliography of the subject is, of course, kept up to date in *A Bibliography of Toxoplasmosis and Toxoplasma Gondii* by Eyles and Frenkel [above]. The book is well produced and the pictures are informative but the type is not easy for the English eye to read.

I. A. B. Cathie

Westphal, A. Zur Systematik von *Toxoplasma gondii*. Die Toxoplasmen als Trypanosomidae. [**Systematic Position of** *Toxoplasma gondii*. **Toxoplasms as Trypanosomids**] *Ztschr. f. Tropenmed. u. Parasit.* Stuttgart. 1954, Apr., v. 5, No. 2, 145–82, 13 figs. [Numerous refs.]

The systematic position of *Toxoplasma gondii* has been a puzzle ever since its discovery in 1908. Originally this parasite was referred to *Leishmania*, but later, when its peculiar nature was recognized, it was given the independent generic status under which it is now known. Since then it has been classified among or near the Sporozoa, next to Sarcosporidia. On the other hand, some observers even doubt whether *Toxoplasma* is a true protozoon.

In the present paper, the author makes a bold attempt to attach this parasite to the large flagellate family Trypanosomidae. It is pointed out that, like the pathogenic Haemoflagellates (*e.g.*, *Trypanosoma gambiense*, *T. cruzi* and *Leishmania donovani*), *Toxoplasma* is infective to a wide range of hosts, whereas the Sporozoa are characterized by host restriction. Morphologically *Toxoplasma* is said to resemble the leishmanial stages of *Leishmania* and *Trypanosoma cruzi*, and like these forms it typically reproduces by longitudinal binary fission, though—it is claimed—occasionally it may also divide by multiple fission, like some of the Haemoflagellates. However, *Toxoplasma* differs from the Trypanosomidae in the absence of a kinetoplast

(=German *Blepharoplast*). To explain this essential difference the author draws a parallel with the loss of the kinetoplast among trypanosomes, some of which (*e.g.*, *T. evansi*, *T. equiperdum*) are no longer capable of developing in the insect vector and have become monogenetic parasites of mammals. This emancipation from the intermediate host is associated with the disappearance of the kinetoplast, exemplified in the completely akinetoplastic *T. equinum*. Although this phenomenon has hitherto not been demonstrated in *Leishmania*, the author assumes that *Toxoplasma* has evolved from the latter by its adaptation to parasitism in vertebrate hosts exclusively and by the permanent loss of its kinetoplast in the process.

Another feature distinguishing *Toxoplasma* from the Haemoflagellates is the absence of a flagellum. But the author points out that by phase microscopy it is possible to detect in some toxoplasms the presence of a fine vibratile filament protruding from the pointed end of the body, as shown in some of the photomicrographs illustrating the paper. The author admits that, owing to the delicate structure of this evanescent filament, it cannot be identified with certainty with a typical Trypanosomid flagellum, but argues that it might represent a rudimentary flagellum, for the full development of which the necessary biological factors (*e.g.*, those obtained in the insect vector) are absent.

Like the monogenetic trypanosomes—and especially the akinetoplastic strains—toxoplasms are incapable of growing *in vitro* in those artificial media which imitate the conditions in the intermediate host. The assumption that *Toxoplasma* is an akinetoplastic leishmania is further supported, according to the author, by its failure to develop in arthropods, its transmission taking place by contamination with the faeces and urine, as in *Leishmania*, which is also capable of being transmitted with the excreta of the host. In support of the affinity of *Toxoplasma* with the Haemoflagellates, the author also points out that both in toxoplasmosis and in Mediterranean kala azar dogs serve as reservoirs of the human disease. It is further noted that the clinical symptoms of toxoplasmosis have many features in common with those of human diseases caused by Haemoflagellates, especially Chagas's disease and the leishmaniases, in all of which the parasites invade the tissues. A detailed comparison is made of clinical manifestations in human infections with *Toxoplasma*, *Trypanosoma gambiense*, *T. rhodesiense*, *T. cruzi*, *Leishmania donovani*, *L. tropica* and *L. brasiliensis*. They are conveniently summarized in a table, where the histotropisms and pathological effects produced by these parasites are given side by side, showing that the host-parasite relations and symptoms of toxoplasmosis have their counterpart in one or the other of the haemoflagellate infections, especially in Chagas's disease.

[The hypothesis advanced by the author is an ingenious attempt to determine the systematic position of *Toxoplasma*. Unfortunately it is purely speculative, since the absence in this parasite of a kinetoplast and a flagellum, which are the main cytological features distinguishing it from *Leishmania*, is dismissed by postulating an imaginary evolution of the former from the latter, in the course of which these organoids were lost. It may be recalled that in trypanosomes, in addition to completely akinetoplastic strains and species (*e.g.*, *T. equinum*), a varying proportion of organisms in normal strains are also devoid of a kinetoplast (*cf.* Hoare, this *Bulletin*, 1954, v. 51, 892), but so far no evidence has been produced of the disappearance of this organoid in *Leishmania*. As regards the flagellum, which is characteristic of all the Trypanosomidae at least in some stage of their life-cycle, when seen its nature is unmistakable, whereas in the case of *Toxoplasma* the author has to resort to unconvincing arguments in an attempt to prove its very existence. Until all these doubtful points are satisfactorily solved the affinity

of *Toxoplasma* with the flagellates will remain uncertain and its systematic position unsettled.] *C. A. Hoare*

Jacobs, L. & Melton, Marjorie L. **Modifications in Virulence of a Strain of *Toxoplasma gondii* by Passage in Various Hosts.** *Amer. J. Trop. Med. & Hyg.* 1954, May, v. 3, No. 3, 447–57. [12 refs.]

Differences both in the clinical manifestations of human and animal toxoplasmosis and in the course of laboratory infections point to the existence in *Toxoplasma* of strains varying in virulence. In the present paper the authors describe observations on the changes in a strain (*113*) obtained from dog ticks (*Rhipicephalus sanguineus*) used in attempts to transmit toxoplasms. The macerated bodies of the ticks were inoculated intraperitoneally into mice, whose tissues were similarly sub-inoculated into other mice. Toxoplasms in small numbers were detected only in one of the animals in the latter passage. From this mouse 6 further passages were made before parasites could be revealed again. From the foregoing observation, occupying 4 months, it was evident that strain *113* was of low virulence.

In addition to the intraperitoneal passages (*IP*), the strain was also passaged in 2 other lines: through chick embryos (*CE*), and intracerebrally inoculated mice (*IC*). Though the parasites could not always be demonstrated in the host, especially in the early passages, these three lines were maintained by regular subinoculations. The changes in the virulence of this strain were studied by comparing the behaviour of the different lines in mice. When first started, line *IP* produced no symptoms of disease in these animals, but after 62 continued passages in the course of one year its virulence gradually increased, so that it killed not only mice, but also became pathogenic to rabbits, guineapigs and hamsters. However, parallel passages of line *CE* behaved differently, for it remained less virulent for these rodents and for mice, but this line was invariably lethal to the chick embryos. Immunological tests, by challenging mice inoculated with *CE* with strain *RH*, revealed a lack of cross immunity. As regards line *IC*, though lethal for mice, it was less virulent to them than *IP*, as shown by the longer survival time.

In the course of these experiments tests were carried out which showed that the increased virulence of strain *113* was not due to concomitant infections with viruses or bacteria. The mechanism of the alteration of virulence of this strain could not be determined, but it is thought to be due to a sudden change in the destructive power of the toxoplasms for the host's cells.

C. A. Hoare

Schmidtke, Liselotte. Bemerkungen zur Verfütterung von *Toxoplasma* an Versuchstiere. [**Transmission of *Toxoplasma* to Experimental Animals by Mouth**] *Ztschr. f. Tropenmed. u. Parasit.* Stuttgart. 1954, Apr., v. 5, No. 2, 182–3.

The author describes experiments which demonstrate the inability of *Toxoplasma* to infect laboratory animals by the oral route. When the infective material is introduced into the mouth of mice, hamsters, guineapigs and rabbits by means of a pipette, a drop of the inoculum is invariably expelled on to the snout, and finds its way into the nasal cavity. This results in infection, which is erroneously attributed to inoculation *per os*. In fact, when lightly anaesthetized mice were inoculated with a drop of toxoplasm suspension introduced into the nose, the animals became infected and died within 9 days after inoculation. Failure to infect laboratory animals

by the mouth was demonstrated by inducing them to lap up milk, containing the parasites, from a small basin. Over 100 mice were repeatedly fed in this way without acquiring an infection, whereas control animals, which were inoculated intraperitoneally with the remains of the infected milk, became infected and died. *C. A. Hoare*

DERMATOLOGY AND FUNGUS DISEASES

Vieira, J. P., Fonzari, M. & Goldman, L. **Some Recent Studies in Brazilian Pemphigus.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 868–77, 8 figs. [25 refs.]

Brazilian pemphigus may be acute, subacute or chronic. The last comprises abortive (Senear-Usher or pemphigus erythematosus type), bullous, foliaceus, erythrodermic, pustular, dystrophic, hyperpigmented, papillomatous and herpetiform varieties. Clinically and histologically it resembles the pemphigus foliaceus of Europe and North America. Epidemiologically the endemic zone includes the states of Bahia, Goiás, Mato Grosso and São Paulo. In some areas the epidemic foci appear to be spreading.

It is generally believed to be an infectious disease although the authors consider the possibility of soil contamination with a heavy metal.

In therapy local applications of hydrocortisone acetate have been unsuccessful in the authors' hands, possibly because of the severe tissue change. Topical and oral erythromycin were valuable in the infected stage. Recently antimalarial drugs have been found of value. Mepacrine has been used in doses of 0·3 to 0·6 gm. daily and reactions have been surprisingly few although the drug has been given for long periods of time. Although safer, chloroquine does not appear to be so effective especially as regards the exudation. Studies are now under way with plaquenil sulphate. BCG vaccination also appears useful as a non-specific form of shock therapy for the *forme fruste* type of case. *H. T. H. Wilson*

Andleigh, H. S. **Mycetoma Foot. Etiology and Laboratory Diagnosis.** *Indian J. Med. Sci.* 1954, Sept., v. 8, No. 9, 631–4, 6 figs. on pl.

The author studied 22 cases of mycetoma affecting the lower limbs; 6 were caused by species of *Nocardia* and 16 by *Madurella mycetomi*. Cultures were obtained from the yellowish-white " grains " of 4 of the nocardial infections and were identified as *Nocardia asteroides* (2), *N. madurae* and *N. pelletieri*. Attempts at culture from the characteristic black grains of *Madurella mycetomi* were successful in only 2 out of 12 cases. Characters of the cultures are not described.

In tissue sections, the colonies (grains) of the *Nocardia* species stained well by Gram's method which clearly demonstrated the structure of the colony and the slender mycelium of the organism, that of *N. asteroides* being made up of bacilliform articles measuring 0·5 to 1·0 μ in thickness and 6 to 10 μ in length; Gram's stain was not suitable for the *Madurella* colonies. The periodic-acid-Schiff (PAS) technique [see Kligman and Mescon, *Bulletin of Hygiene*, 1951, v. 26, 825] proved unsuitable for staining the nocardial grains but picked out the mycelium very sharply in the *Madurella* grains. The mycelium of *M. mycetomi* was coarse, branched

and septate, the segments measuring from 3 to 4 μ in thickness and from 10 to 12 μ in length, it was embedded in a hyaline matrix and the colony was surrounded by hyaline, eosinophile club formations.

As *M. mycetomi* is difficult to isolate in culture and develops slowly, the author considers that an early diagnosis should be based on the histology of biopsy specimens, so that the appropriate treatment may be undertaken without delay.

In both the nocardial and *Madurella* infections the bones were involved, but later in the nocardial than in the *Madurella* cases. In one of the nocardial cases the lesions occurred on the leg and thigh and not on the foot.

In treatment, surgical excision followed by sulphonamide and penicillin therapy may be employed in the nocardial cases, but chemotherapy is of little use in *Madurella* infections and amputation may be necessary.

J. T. Duncan

Brass, K. Zur histologischen Diagnostik der Pilzerkrankungen. [**The Histological Diagnosis of Fungus Diseases**] *Schweiz. med. Woch.* 1954, Nov. 6, v. 84, No. 45, 1273–5, 5 figs.

The author starts by stressing the two distinct forms of fungus diseases of man; one associated with surface parasites, or more or less saprophytic fungi such as *Candida albicans*, and the other with fungi which gain entrance into the body, such as blastomycetes, coccidioidomycetes and histoplasma. The increasing frequency of such cases has been ascribed by several medical practitioners to the recent extensive use of antibiotics, for many of the patients have been undergoing long courses of these antibiotics.

In determining the cause there are two points of importance: the tissue reactions and the causal organism itself—in other words, histological diagnosis. Some, *e.g.*, actinomycosis, are easily recognized by their very structure; others, *e.g.*, blastomycosis, or paracoccidioidomycosis of Brazil, by the tissue reaction, the presence of epithelioid and inflammatory cells, small caseous gummatous masses with foreign body cells of the Langhans type, or small abscesses of skin and mucosae. Post mortem, when there is plenty of material available, there is little if any difficulty, but *intra vitam* only minute fragments may be obtainable and then it is of importance to be able to recognize the causal organism rather than the tissue reaction to it. The author takes, for example, South American blastomycosis—paracoccidioidomycosis—and describes, or refers to, various methods of staining. He favours in particular Gridley's method (*Amer. J. Clin. Path.*, 1953. v. 23, No. 3, 303) or, for rapidity and certainty, the use of phase-contrast methods by polarized light, by which large, optically inactive cysts with spores are seen to be uncommon in the young elements. Photomicrographs are reproduced which show the tissue changes as well as would be expected in black and white reproductions of stained sections.

H. Harold Scott

Chinn, H. I., Mitchell, R. B., Bieberdorf, F. W. & Arnold, Anna C. **Effectiveness of various Compounds against** *Coccidioides immitis*. *Antibiotics & Chemotherapy*. New York. 1954, Sept., v. 4, No. 9, 982–7. [12 refs.]

Thirty-seven compounds, 18 being given chemical or trade names and 19 denoted only by numbers (the structures of all are given) were tested for capacity to inhibit the growth of *Coccidioides immitis in vitro*. There were some wide strain variations in sensitivity, and variations in the ratio

between concentrations inhibiting growth partially and totally. Stilbamidine was the most active compound, and the testing of related diamidines is thought worth while. Eight other compounds, of which 6 are described as anti-histaminics, had a comparable though lesser degree of activity. That of isonicotinic acid hydrazide [isoniazid] and related substances was weak. *L. P. Garrod*

Drouhet, E. & Zapater, R. C. Phase levure et phase filamenteuse de *Paracoccidioides brasiliensis*; étude des noyaux. [**Yeast Phase and Filamentous Phase of** *Paracoccidioides brasiliensis*; **Study of the Nuclei**] *Ann. Inst. Pasteur.* 1954, Oct., v. 87, No. 4, 396–403, 1 text fig. & 15 figs. on pl. [12 refs.]

In a cytological study of *Paracoccidioides brasiliensis*, with particular reference to the nucleus, the authors found the staining technique of DeLamater (*Mycologia*, 1948, v. 40, 423) more satisfactory than that of Feulgen or of Robinow. The study was made on the yeast form of the fungus in saprophytic culture and in parasitic life, and on the mycelial form in culture.

For study, the yeast and mycelial forms from culture were fixed with Schaudinn's fluid, and the parasitic form, in the tissues of experimentally infected hamsters, with Carnoy's fluid. Hydrolysis of all preparations, before staining, was effected with N/1 hydrochloric acid at 60°C. for 10 minutes. After washing, the preparations were treated with 1 per cent. formol for 4 minutes, washed again and stained with 0·25 per cent. basic fuchsin in N/25 hydrochloric acid. For the yeasts from culture, the staining time was approximately 8 minutes, but for the mycelium, which was more resistant, from 15 to 30 minutes were required according to the preparation, and for the tissue sections about 3 hours. After staining, the preparations were passed through 10, 20 and 30 per cent. alcohol successively, then acetone and xylol and mounted in balsam.

In the yeast phase from culture, the young free cells are multinucleate, the resting nuclei being uniformly distributed in the cytoplasm. As the cell develops, the nuclei migrate to the peripheral part and undergo division in which apparent mitotic figures may be seen. At this stage multiple peripheral budding of the cell takes place and a single nucleus migrates into each bud and soon undergoes successive divisions so that the bud becomes multinucleate while still attached to the parent cell. After separation the daughter cell undergoes the developmental changes just described. The parent cell, greatly increased in size, shows a reduced number of resting nuclei, which are usually disposed around large cytoplasmic vacuoles. The parasitic yeast form, which was less satisfactory than the culture form for this kind of study, showed the same nuclear stages as the culture yeast. The nuclei of the mycelial form from culture were more difficult to stain than those of the yeast form. They were relatively few and widely spaced, but at more or less regular intervals, each mycelial article containing 1 or 2 nuclei.

The yeast form of *Blastomyces dermatitidis* is also multinucleate and resembles, in this respect, that of *P. brasiliensis*, and both differ from the uninucleate yeast cells of *Candida albicans*, *Histoplasma capsulatum* and *Sporotrichum schencki*. For this reason the authors consider that *P. brasiliensis* and *B. dermatitidis* are generically similar and *B. dermatitidis* should be transferred to the genus *Paracoccidioides*, the generic name *Blastomyces* being treated as *nomen nudum*. *J. T. Duncan*

See also p. 181, Berte, Les manifestations cutanéo-muqueuses des helminthiases intestinales [**Cutaneous and Mucous Membrane Manifestations of Intestinal Helminthiasis**]

Simons, R. D. G. Ph. [Edited by.] **Medical Mycology.**

This book was reviewed in this *Bulletin*, 1954, v. 51, 1324.

TROPICAL OPHTHALMOLOGY

Poleff, L. Au sujet des difficultés de recherches en trachomatologie expérimentale. Bilan des résultats obtenus au Maroc. [**Difficulties in Experimental Study of Trachoma. Results obtained in Morocco**] *Maroc Méd.* 1954, Mar., v. 33, No. 346, 258–60. [15 refs.]

This short paper recapitulates much of what the author expressed in an earlier paper in the same Journal in 1953 (*Maroc Méd.*, 1953, v. 32, No. 336, 501) concerning the international coordination of trachoma research and the necessity for special laboratories. He emphasized that experimental work alone cannot be expected to solve the basic problems of trachoma, and the laboratory must always be closely associated with a clinic specializing in the treatment of trachoma. He gives a considerable amount of detail concerning the biological recognition of the trachoma virus and the difficulties encountered in separating it from similar bodies.

The author expressed gratification at the interest taken in the coordination of trachoma research by the World Health Organization.

D. P. Choyce

HEAT STROKE AND ALLIED CONDITIONS

Waugh, W. H. **Cortisone and the Treatment of Heat Stroke.** *Ann. Intern. Med.* 1954, Oct., v. 41, No. 4, 841–3, 1 fig. [12 refs.]

" Orally administered cortisone in one case and parenterally administered cortisone in another were without effect on either the hyperpyrexia or the anhidrosis of heat stroke.

" Cortisone appears of no value as an antipyretic adjunct in the treatment of heat pyrexia."

MISCELLANEOUS DISEASES

Williams, A. W., Ball, J. D. & Davies, J. N. P. **Endomyocardial Fibrosis in Africa: its Diagnosis, Distribution and Nature.** *Trans. Roy Soc. Trop. Med. & Hyg.* 1954, July, v. 48, No. 4, 290–305, 4 figs. (2 on 2 pls.). [55 refs.] Discussion 306–11. [17 refs.] [Bedford, D. E.; Hawe, A. J.; Gray, I. R.; Beet, E. A.; Ball, J. D. (in reply).]

This syndrome has been the object of detailed study by Professor Williams and his team during the last 8 years, and in this paper they draw

attention to its high incidence in Uganda, the difficulties of clinical diagnosis, the geographical distribution, and problems concerning its pathogenesis and aetiology.

Their patients were Africans of all ages and of each sex. Four main clinical patterns of the disease were found. In the first, the left ventricle was mainly affected and the clinical result was simple bilateral heart failure. In the second, there was obliterative fibrosis of the right ventricle producing right heart failure. In the third, the posterior cusp of the mitral valve was adherent to the ventricle producing mitral incompetence; and in the fourth, tricuspid incompetence was produced by adherence of the posterior cusp of this valve to the ventricle.

In a series of 231 autopsies on patients who had died of heart failure at Mulago hospital endomyocardial fibrosis was found in 33 cases; it was the third most important cause of death in this series, being exceeded only by syphilitic aortitis and renal hypertension. In a series of 157 in-patients it was diagnosed in 35, renal hypertension in 32 and syphilitic aortitis in 29.

Knowledge of the world distribution of the disease is as yet incomplete but from personal enquiry and from perusal of the literature the authors conclude that it occurs not only in the inhabitants of Uganda and neighbouring territories but in the Sudan, Nyasaland, Southern Rhodesia, West Africa and occasionally in the United States of America, Great Britain and Europe.

Regarding the aetiology and pathology it is stated that endomyocardial fibrosis appears to be the end result of a process of whose cause and development we are largely ignorant. It appears to be caused by one or possibly several different pathological processes. One possibility is that transient disease injures the parietal endocardium and initiates the formation of a local fibrin thrombus which later organizes and fibroses, and still later becomes covered by new endocardium. There was, however, also evidence of injury and fibrosis to the inner part of the heart wall in some of the patients and this may have been due either to the action of a toxin injurious to cardiac muscle or to " sustained hypoxia or depletion of some nutrient essential for this tissue ". Although the aetiological factors likely to cause such processes are unknown, infection, allergy, rheumatic heart disease, toxaemia and malnutrition are possibilities. It is also pointed out that viruses capable of causing myocardial injury have been isolated from captive chimpanzees and gibbons. No eosinophilia has been found to support the suggestion of allergy as a cause of the disease. The distribution of the fibrosis in endomyocardial fibrosis differs from that in rheumatic carditis for in the former the cusps tend to be involved and in the latter the apex and walls of the ventricle. It may, however, come into the category of a collagen disorder, with endocardial fibrosis as a secondary feature. Chronic liver damage and low serum albumin values have been found in some of the cases of the series, but in others evidence of malnutrition has not been present. In the histories of the patients there was nothing to indicate that toxic doses of drugs had been taken.

In the discussion which followed, Dr. D. Evan Bedford stated that the disease as seen by him in 1946 in West Africa was similar to that described by the Mulago workers. He pointed out that a similar disease had been described in Europe as long ago as 1901 although it is there a rarity. Cardiac enlargement and myocardial fibrosis associated with hypoplasia of the aorta is an occasional cause of unexplained heart failure and aortic hypoplasia was present in many of his African cases of endomyocardial fibrosis. In the latter the main clinical features were " rapid onset of congestive heart failure, often starting as left heart failure and pulmonary

oedema, and quickly progressing to right heart failure with swollen liver and dropsy. The heart was grossly enlarged, sometimes simulating a pericardial effusion. . . The rhythm remained normal, apart from extra-systoles, and fibrillation was not observed. . . The blood-pressure was low ".

Dr. Bedford stated that there was certainly no immediate relationship between malnutrition and heart failure in his cases but if there had been malnutrition in childhood, heart failure might still be an end result. In this connexion the aortic hypoplasia was a significant finding. While he considers the evidence in favour of a nutritional origin of the disease to be strong, he does not consider it yet to be conclusive.

Dr. A. J. Hawe reported that in Accra rheumatic heart disease is rare. Recurring attacks of congestive heart failure are, however, seen in young and middle-aged adults in whom there is evidence of mitral incompetence and a marked tendency to alternation. Cardiac failure presenting with gross ascites and hepatomegaly is also found in children between the ages of 5 and 15 years. These children have engorged jugular veins and effusion of straw-coloured fluid containing leucocytes into the pericardium. No tubercle bacilli have been found in this fluid and animal inoculations have proved negative. Their illness is prolonged but remits and during periods of remission they suffer from remarkably little distress. Both the adults and the children have been suspected of suffering from endomyocardial fibrosis but in autopsies done in Accra this disease has not yet been found.

Dr. I. R. Gray drew attention to the fact that he had seen a case in a European who had so far survived the illness, and that in two of the cases he had seen a high eosinophilia had been present.

Dr. E. A. Beet stated that during the past 3 years he had studied 255 patients suffering from heart disease in Nigeria; 10 per cent. had had cardiac failure of obscure origin and he suspected that most if not all of these had been suffering from endomyocardial fibrosis. He had performed post-mortem examinations in 46 of the 74 fatal cases in the series and found endomyocardial fibrosis to be present in one. He had the impression that although rheumatic disease may be uncommon along the coast of West Africa it is frequently encountered in the drier, open, savanna country of the hinterland.

Dr. J. D. Ball in concluding the discussion drew attention to the fact that in East African cases he and his colleagues had not seen embolic infarcts unless the disease was complicated by terminal bacterial endocarditis. In cases reported from the U.S.A. and Europe, however, embolism had been common. *A. W. Woodruff*

O'Brien, W. **Endocardial Fibrosis in the Sudan.** *Brit. Med. J.* 1954, Oct. 16, 899–901.

This paper describes in general terms the clinical features in 25 cases of heart failure (with fuller accounts in 7) in which none of the classical causes could be implicated, and which the author considered to correspond closely to descriptions of endocardial fibrosis. This was confirmed in two cases at autopsy. In the author's experience heart failure of obscure aetiology predominates in the Sudan; and this series would have been still larger had he not been careful to exclude from it cases of mitral incompetence, as of possible rheumatic aetiology.

Most of the patients were of Arab stock; all were adults, the majority in the fifth decade. They came from all over the Sudan and from a variety

of occupations. They were generally of good physique; malnutrition is mentioned in connexion with one of the autopsy cases, but was not a feature in the series. There was no consistent association with infection. Anaemia was present in one; eosinophilia in two. Liver biopsy in 11 showed passive congestion only; advanced cirrhosis was found post mortem in one.

Symptoms were of recent onset, commonly beginning with dyspnoea, followed by those of systemic congestion with high venous pressures. A loud apical systolic murmur was common. Conspicuous enlargement of the left auricle was absent. [The exclusion of mitral incompetence should be remarked; though the grounds for inclusion or exclusion in this respect are not made clear.] In the cardiograms, conduction defects and pathological T changes were noted. Embolic incidents are stated to be a feature exemplified by pulmonary infarction in 4 cases and a probable cerebral embolism in one. Nine patients died under observation; the rest all left hospital without congestive failure.

The autopsy descriptions are all too brief. The right ventricle was most severely affected, with endocardial fibrosis and tricuspid incompetence, in both cases in which autopsy findings are given. In both involvement of the left ventricle also is implied. Mural thrombus was present in the right ventricle in one case, in the right auricle in the other. The coronary arteries were normal. There are no details of the myocardium.

[Coming from an area where autopsy proof is hard to come by, this paper is of special interest. It affirms once again the large proportion of cases of heart failure without classical aetiology commonly encountered in Africa. Whether all in this series had endocardial fibrosis must remain in doubt—especially in view of the considerable clinical improvement in the majority. But its occurrence in Khartoum is proved, thereby extending the recorded distribution of this condition into a region preponderantly Arab. The absence of details of morbid anatomy and histology is disappointing, but this is a clinical paper. It is to be hoped that an account of the pathology will yet be published. See also this *Bulletin*, 1954, v. 51, 839.]

A. W. Williams

Saave, J. J. **Appendicitis in the Tropics and its Pitfalls: a Clinical Investigation with Report of Two Cases.** *Med. J. Australia.* 1954, Sept. 18, v. 2, No. 12, 465–7. [20 refs.]

The author describes two cases of appendicitis in natives of New Guinea successfully operated upon; the first case was an example of an obstructed appendix with the distal portion on the verge of gangrene, the second was retrocaecal appendix moderately inflamed. Both patients admitted taking diets which were of partly European character.

In 23,061 in-patients during 3 years at Rabaul there were only 2 cases of appendicitis. Appendicitis is rare in primitive people as long as they keep on a diet rich in carbohydrate and cellulose [Manson-Bahr, this *Bulletin*, 1946, v. 43, 607], but when they take mixed diets of European pattern the incidence increases. Appendicitis is said to be fairly frequent in Africans in the larger centres in the Belgian Congo, with abscess in 30 per cent. and general peritonitis in 10 per cent.

Some of the diseases prevalent in the tropics which may be confused with appendicitis are: (1) intestinal amoebiasis—in Panama amoebic lesions were found in 80 per cent. of all appendices removed surgically; (2) genito-urinary schistosomiasis, which may be accompanied by acute appendicitis due to an accumulation of ova in the wall of the appendix; (3) paragonimiasis (endemic haemoptysis); (4) Weil's disease (leptospirosis) may

simulate appendicitis with sudden onset and abdominal pain; (5) enteric and relapsing fevers; (6) spider poisoning; (7) primary bubonic plague; (8) lymphogranuloma venereum in the form of terminal ileitis; (9) subtertian malaria of gastro-intestinal type; (10) intestinal worms, *Taenia saginata*, *Ascaris* or *Enterobius vermicularis* may invade the appendix.

W. L. Harnett

Davies, J. N. P. & Wilson, Barbara A. **Cancer in Kampala, 1952–1953.** *East African Med. J.* 1954, Sept., v. 31, No. 9, 395–416. [27 refs.]

This paper deals with the results of a survey of cancer in the Kampala, Uganda, area by a Committee consisting of a surgeon, a physician and 2 pathologists collecting information from the 5 hospitals in Kampala. The survey is retrospective for 1952 and 1953, a pilot survey in 1951 having established that practically all patients seen in the out-patient department with signs and symptoms suspicious of cancer were admitted to hospital forthwith, except in the cases of certain patients with uterine cancer, or those with very advanced disease who refused admission.

Of the 796 cases it is believed that in 766 there was an undoubted malignant neoplasm, the other 30 being meningiomata, Kaposi sarcomata or precancerous conditions. A table shows the distribution by site of each pathological type of neoplasm, with the numbers diagnosed histologically (over 70 per cent.), from biopsy 61·6 per cent. and from autopsy 9·6 per cent. The autopsy series is grossly overweighted by hepatic carcinoma and the biopsy series by skin malignancy. There were 26 cases in Europeans, 36 in Asians, and the rest were in Africans; the apparently high incidence in Europeans is due to their greater willingness to seek treatment and to the high incidence of rodent ulcer. Lack of information as to age, sex, tribe and area of residence in many cases makes it impossible to calculate cancer rates for Africans, though the population of each district is known. There are so many differences between tribal groups in diet, habits, social customs, etc., that they may well affect the cancer pattern. The 1948 Census showed that in Kenya only 8·7 per cent., in Tanganyika 10 per cent. and in Uganda 11·6 per cent. of the population are over the age of 45. In the Kampala hospitals males are 4 or 5 to one female, but the ratio is still higher over the age of 45, as elderly females rarely come to hospital.

The authors draw attention to some of the striking differences in the percentages of different types of cancer in their survey and those recorded by Harnett in *A Survey of Cancer in London*, 1952 (BECC) [*Bulletin of Hygiene*, 1952, v. 27, 747]. For instance, there were 56 cases of primary carcinoma of the liver in Kampala, making 9·34 per cent. of all male cases against 0·16 per cent. in London; and there were 26 cases of Kaposi sarcoma to one in London. There would appear to be a paucity of carcinoma of the upper air passages and of the oral cavity as compared with London. On the other hand salivary cancer appears to be more common in Africans, as it is in other tropical dwellers. All cancer of the gastro-intestinal tract is less common in Uganda: stomach 4·1 per cent. of all cases against 12·2 in London; colon 1·3 against 5·8 per cent.; rectum 2·39 against 12·1 per cent. Figures for females showed much the same disproportion. There is a gross preponderance of penile carcinoma in Africans, 9·13 against 0·95 per cent. The frequency of carcinoma of the male breast is noticeable, 0·87 against 0·33, as is the comparative infrequency of the disease in the female breast, 8·38 against 29·7, possibly the result of prolonged lactation. Carcinoma of the cervix uteri amounts to 18·8 compared with 11·9 per cent. in London. In males there is a great excess of skin

cancer, 15·0 to 9·4 per cent., epithelioma of the feet and legs preponderating, nearly all on a basis of old chronic ulceration. There was only one definitely diagnosed glioma in this series.

Of the 56 cases of primary hepatic cancer, one was a reticulum-cell sarcoma and the rest were considered to be true hepatomata except for 3 cholangiomata among the females and one among the males. All the hepatomata except one were accompanied by cirrhosis. The incidence of teratoma of the kidney was very high, 15 cases with histological diagnoses in 7. Carcinoma of the bladder was about as common as in London and in no case did it appear to be a complication of schistosomiasis, as has been found in other parts of Africa, but this parasite is rare in Kampala. Reticulo-endothelial tumours form a considerable proportion of the total neoplasms in Africans, 5·5 per cent. of all cases against 0·8 per cent. in London.

[A survey of this kind is of great use in indicating lines along which research into social and environmental aetiology may yield results of importance.] *W. L. Harnett*

Krishnan, M. K. R. **Mites as an Aetiological Factor in Tropical Eosinophilia.** *J. Indian Med. Ass.* 1954, Oct. 1, v. 24, No. 1, 5–7.

Sputa from 39 cases of tropical eosinophilia were examined for mites. Following the method of Carter, Wedd and D'Abrera (1944) [this *Bulletin*, 1945, v. 42, 73] a 24-hours specimen of sputum was collected in a sterile culture bottle containing 10 cc. of 5 per cent. potassium hydroxide. To this were added 10 cc. more potassium hydroxide, sufficient formalin to make a 10 per cent. concentration, and 15 to 20 drops of Löffler's methylene blue. The bottle was kept closed for 24 hours and then centrifuged for 10 minutes at 5,000 revolutions per minute. The deposit was mounted on a slide and examined. In only 4 cases were any mites found and in each positive case only 2–4 mites were detected. One mite was found in the mouth washings of a mite-positive patient and mites in the sputum of the other cases were thought to be derived from the buccal cavity. One mite was in the hypopal stage while all the others were adults. This suggests that they do not breed in the human respiratory tract.

The affected patients were not engaged in occupations which exposed them to a mite-laden atmosphere. Ten persons who worked in mite-infested godowns were examined, but no clinical or haematological evidence of tropical eosinophilia was found in any of them. The author does not consider that mites are responsible for this disease.

Other investigations included the erythrocyte sedimentation rate which was high in most cases, and the WR and Kahn reaction, which were negative in all. The cold agglutination test was negative in 6 cases and liver biopsy inconclusive in one. A monkey inoculated intranasally with sputum remained alive and well. *H. T. H. Wilson*

McKay, G. F., Lalich, J. J., Schilling, E. D. & Strong, F. M. **A Crystalline " Lathyrus Factor " from** *Lathyrus odoratus*. *Arch. Biochemistry.* 1954, Oct., v. 52, No. 2, 313–22, 3 figs. [16 refs.]

" The purpose of this study was to isolate the toxic factor from crude *Lathyrus odoratus* meal. Rats were used in assays for the toxic factor, and the presence of skeletal deformities as revealed by x-ray was used as

the chief criterion of lathyrus toxicity. A crystalline substance was isolated which produced bony changes exactly similar to those seen in rats fed the toxic meal. Analyses of the purified toxic factor agreed with the formula $C_8H_{13}O_3N_3$."

PARASITOLOGY: GENERAL

J. Parasitology. 1954, Oct., v. 40, No. 5, Sect. 2 (Suppl.), 71 pp. **Program and Abstracts of the Twenty-Ninth Annual Meeting of the American Society of Parasitologists, Memphis, Tennessee, November 3, 4, 5, 6, 1954.**

This publication gives the usual list of papers and abstracts of them. There are 122 abstracts. Most of the papers were presented by different authors but a number of authors wrote 2 to 4 each. The presidential address, by Cornelius B. Philip of the Rocky Mountain Laboratory, was entitled "There's Always Something New Under the 'Parasitological' Sun".

In a joint meeting of the Society with the American Society of Tropical Medicine and Hygiene, a symposium on Schistosomiasis was introduced by Dr. D. B. McMullen of the U.S. Army Medical Service Graduate School. Apart from this symposium, there were 22 other papers on schistosomiasis. There were 5 papers on amoebiasis of direct interest to readers of this *Bulletin*, and several on human and avian malaria, trypanosomiasis, toxoplasmosis, mosquitoes and various helminthic infections.

H. J. O'D. Burke-Gaffney

Wang, W. L. L. & Dunlop, S. G. **Animal Parasites in Sewage and Irrigation Water.** *Sewage & Indust. Wastes.* Champaign, Ill. 1954, Aug., v. 26, No. 8, 1020–32, 1 fig. [15 refs.]

This paper reports on the incidence of animal parasites in sewage at various stages in its treatment and in the irrigation water which in the western United States is much used for many vegetable crops. The collection of samples from the Denver sewage works and the South Platte river above the works is described. Treatment at the sewage plant consists in short-period aeration, followed by primary sedimentation and final chlorination of the effluent. Comparison of the Foerst continuous centrifuge and the Sedgwick-Rafter sand filter for the concentration of sediments was made and the experimental results led to the adoption of the former method. The results of experiments to determine the best methods for the recovery of helminth ova and protozoan cysts from the sediments indicated that the zinc sulphate centrifugal-flotation method was the best for the recovery of *Ascaris* ova and the aerosol-ether-xylene was most efficient for the recovery of *Entamoeba coli* cysts.

Some enquiry was also made into the coliform and enterococcal counts. The results of all the experimental work are fully described and discussed. Some of the findings were: (1) about 20 per cent. of the *Ascaris* ova and 46 per cent. of the *Entamoeba coli* cysts found in Denver raw sewage were still present in the final effluent whereas coliform and enterococcal bacteria were reduced in probable number by 99 per cent.; (2) after the effluent joined the river the incidence of *Ascaris* ova and *Entamoeba coli* cysts was considerably reduced but the bacterial counts were larger; (3) other helminth ova were found occasionally during sewage treatment and in the

river but efforts to recover *Entamoeba histolytica* were consistently negative; (4) over 80 per cent. of the *Ascaris* ova recovered were viable; (5) helminth ova were never found in vegetable washings when the sewage plant was in action but they were isolated from 2 out of 7 samples when the sewage plant was inoperative. *M. E. Delafield*

Bintari Sumardjo & Lie Kian Joe. Beberapa parasit jang terdapat pada binatang dan jang ditemukan pada manusia di Indonesia. I. Protozoa. [**Occurrence in Man in Indonesia of Protozoa commonly found in Animals**] *Madjalah Kedokteran Indonesia* (*J. Indonesian Med. Ass.*). 1953, Feb., v. 3, No. 2, 41–7, 12 figs. on pl. [20 refs.]

The English summary appended to the paper is as follows:—

"A review has been given of the protozoal parasites which commonly occur among animals in Indonesia and which occasionally have been found in man.

"1. Cysts of E. [Entamoeba] polecki, a parasite of monkeys and pigs, have been found in an Indonesian boy of six years old. The infection did not cause any symptoms. A description of the cysts has been given.

"2. Balantidium coli has been found as a parasite of man in Indonesia. The first human case was described by Brug in 1919 and another case in 1926. In parts of Indonesia where contact between man and pigs is intimate, human balantidiosis might not be so rare. Johansen (1938) found in Tarutung (Andalas) an infection of 0·1% among 4900 patients and Ave Lallemant (1925) found 50 cases on the island of Flores.

"3. Sarcocystis lindemanni was described in man by Bonne and Soewandi in 1929.

"4. Human Toxoplasmosis has never been seen in Indonesia. The parasites were found in rabbits by Brug in 1925."

ENTOMOLOGY AND INSECTICIDES: GENERAL ZOOLOGY

[Papers on the toxic effects of insecticides in man are abstracted in the *Bulletin of Hygiene* under the general heading of Occupational Hygiene and Toxicology.]

Gold Coast, Govt. of the: **Entomological Report on Development of the River Volta Basin** [Berner, L.]. 84 mimeographed pp., 12 figs., 3 coloured folding maps & 2 folding graphs (1 coloured). [Numerous refs.] 1950, Nov. 30. Gainesville: University of Florida, Florida, U.S.A.

The development plan for the River Volta Basin in the Gold Coast envisages a dam across the river at Ajena about 50 miles from the coast where it breaks through a gorge to the coastal plain. A hydro-electric plant would be constructed in association with the dam and, secondly, a system of perennial irrigation leading off from the reservoir behind the dam to water the rather dry coastal plain east of Accra. Such developments imply changes in the equilibrium of man and his diseases. From June until October 1950, Dr. L. Berner undertook, at the request of the Colonial Office, a survey of the many problems involved. In this report he presents his conclusions as to the risks which may arise not only with the completion of the project but during the transitional period when European and African

immigrant labour would come into the area. Although, as the author emphasizes, such a short survey has obvious limitations, the substance of the report, and the conclusions, are supported by substantial reference to published work, besides other sources. Although primarily concerned with the important insect-borne diseases—malaria, onchocerciasis and trypanosomiasis (in that order of importance)—some indication is given of the situation regarding filarial infections, yellow fever and dengue and, briefly, schistosomiasis and guinea-worm infection.

Two coloured maps make it clear that the River Volta and its tributaries form the principal drainage system of the Gold Coast. The total drainage basin occupies about 139,000 square miles and is cupped, roughly, in a circle of higher forested hills through which the river cuts at the gorge at Ajena to complete its final sweep of about 50 miles across the plains to the coastal estuary at Ada. The dam across the gorge at Ajena will create behind it a reservoir of 1,850 square miles extending for, perhaps, 150 miles up the course of the Volta itself and shorter distances up the tributaries. The width of it will vary usually from 1 to 5 miles according to local topography, although at the confluence of the Volta and the Afram, one of its main tributaries about 15 miles north of the dam, it will be about 25 miles wide. At the present time the Volta is a seasonally flooded river with lowest water levels in April, rising in July to reach a maximum level about October. At low water the river may be 20–40 feet below the top of its banks and at high water there may be, on the other hand, sufficient water to fill the river-course to flood over to form extensive inundations. It is an extremely wide river, being 1,000 yards in width in some places far inland. In the dry season there are 22 areas of rapids above the proposed dam, and two extensive rapids, at Senchi and at Kpong, below the dam site. The former will be obliterated when the reservoir is filled, but the impounding would still leave the Senchi and Kpong rapids much as they are today. A graph and table illustrate the expected levels of the reservoir based on a normal year's rainfall.

Typical riverine vegetation lines much of the banks of the Volta river. The greater part of the river system runs through woodland savanna although areas of thicket occur in the coastal region and the headwaters of some tributaries and some stretches of the Volta itself run through forest.

The southern part of the basin, in which the reservoir would lie, has an average annual rainfall of 54–73 in. with two rainy seasons. January is usually the driest month. North of this a single rainy season lasts from May to October with an annual precipitation of 41–49 in. This is, on the average, hotter and drier than the more southerly region. The desiccating *harmattan* wind after the rains causes a good deal of loss of ground water by evaporation. Charts give meteorological characteristics of four different regions of the Gold Coast for each month of the year.

Population density is illustrated by a coloured map, from which it can be seen that much of the area which would be changed by the reservoir is uninhabited or very lightly populated (up to 10 persons per square mile). Elsewhere north of the dam and in the coastal region below it, densities are as high as 200 persons per square mile.

The report then discusses the present situation and possible and probable effects of the proposed developments on the important insect-borne diseases, malaria, onchocerciasis, and trypanosomiasis, besides the other themes already noted. The problems are considered first as they may be influenced by the development of the River Volta Basin (the dam and reservoir scheme) and, secondly, by the associated Accra Plains Irrigation Scheme. We shall attempt to indicate here only the general scope of the discussion

and conclusions set forth. The author hopes that the report with its conclusions may initiate adequate plans to deal not only with the expectations he suggests but with additional events which only the future could reveal. There are two issues. The protection of immigrant labour, European and African, during construction, and the correction of adverse influences which the completed project may have on the transmission of insect-borne diseases.

Malaria: *Plasmodium falciparum* is the commonest malaria parasite. Although the morbidity of adult indigenous Africans is apparently not appreciable, protection to immigrant staff must be provided and transmission at least not ultimately intensified, in the interests of the local population. Important vectors are *Anopheles gambiae* particularly, *A. funestus* and, so far as a coastal port is concerned, *A. melas*. It is probable that breeding of *A. gambiae* and *A. funestus* would increase along the extensive shore of the reservoir, the former particularly finding suitable pools, etc., as the level of the reservoir falls seasonally. Apparently it will not be feasible to vary the reservoir level frequently to minimize peripheral mosquito breeding and, it is thought, this would not in any case be very useful against *A. gambiae*. No fresh problems are expected below the dam. *A. melas* is a serious difficulty in the development of a coastal port at Ada, and preference is for Teshi, or Tema, near Accra. As regards the effect of the irrigation system on the vectors of malaria, the author quotes largely on this problem from a mimeograph, *Memorandum on Malaria incidental to Irrigation Projects in West Africa*, by Dr. Bruce-Chwatt, Malariologist for Nigeria. This work reviews the effects of irrigation schemes on malarial incidence and vectors in other parts of the world. It is clear that the peripheral limits of an irrigation system where it is used (or abused) by the farmer in his fields or rice fields creates much of the risk of increased mosquito breeding and transmission of malaria. And, elsewhere on such a system, there are many opportunities for unobserved seepages, blockages, and other unintentional imperfections which favour vector multiplication. There is, in Africa, still much need too for more information on the actual significance of rice fields as a breeding place for *A. gambiae*, at different stages of cultivation. It is concluded that there is scope for an advisory and supervisory malaria control staff to cover the problems related to the reservoir and to the irrigation system. An establishment and duties are outlined; the unit would be responsible for coordinating malaria control with engineering developments to obtain the best solution for both interests. European labour should be provided with screened and sprayed premises and prophylactic drugs. The reservoir should be constructed to reduce opportunities for lacustrine breeding; borrow pits dug only above the 260 ft. contour; new villages properly sited and wells provided; drainage of obvious swamp areas both above and below the dam; and, as regards the irrigation system, there will be need for close supervision of its use and maintenance, and education of the African farmer in its proper management. The decision for adult or larval control, or both, by insecticides would, at the time of the report, depend on future trends in the use of the residual insecticides.

Onchocerciasis: The significance of terminal blindness in this disease is strongly emphasized. Although the obliteration of the rapids above the dam would effect control of transmission over a wide area it is necessary to protect the labour force during construction of the dam. Moreover, the rapids below the dam would still exist after the construction was completed. *Simulium damnosum* is the vector of *Onchocerca volvulus* throughout the river system where rapids or fast flowing shallow water suitable to its

breeding exist. The flies are at a peak at the height of the flood season. Recommendations for control envisage protection of constructional labour by aerial spraying with DDT of rapids north to the Obosum tributary (about 60 miles directly from the dam) besides the Senchi and Kpong rapids below the dam. If this is successful in actually eradicating the fly, then the rapids seaward of the dam could not be re-invaded after the reservoir was filled and the up-river rapids finally obliterated. There is a potential danger that *S. damnosum* might breed in some of the faster main canals (3 ft. per sec. flow) of the irrigation system. This could probably be dealt with by dripping DDT into them from suspended containers at distant intervals. Note is taken of the incidence of the disease in the far northern territory and the problem of how the fly survives the long dry season. This deserves investigation lest it harbours features which could cause a breakdown in the attempt to eradicate the fly in the lower stretches of the river. Besides recommending a thorough investigation and supervision of the whole problem by selected specialists, the author suggests immediate remedies which include protective repellents and clothing for constructional staff and labour.

Trypanosomiasis: The vector of importance for human trypanosomiasis due to *T. gambiense* in the area of the two schemes is *G. palpalis*, which is distributed throughout the riverine vegetation. The immediate effect of impounding the waters of the Volta will be the destruction of extensive *G. palpalis* habitats as the reservoir level rises beyond the present river banks. This should give substantial control for some years on its banks but regeneration of riverine vegetation will require to be watched. Preference is for methods of selective clearing, if need for future control becomes manifest. Seaward of the dam the considerable numbers of *G. palpalis* should remain unchanged. But the incidence of the disease is low and it may be dying out. There is need for more data. The potential risk is not clear. It is suggested, however, that immediate immigrant problems should be satisfied by treatment of any local infected persons, examination and treatment of new labour arrivals (and their followers), and control of casual movement within a prescribed area around the dam. The biting nuisance of tsetse is hardly enough to justify tsetse control in the stretch of the Volta from the dam to the sea. The lower Volta already derives indirect benefit from rigorous tsetse control in epidemic centres in the northern part of the territory. The Accra irrigation scheme may well increase the number and spread of *G. palpalis* in the plains due to greater growth of riverine vegetation and a higher level of humidity as a whole. Clearing bush and trees in foci near farmed land and, particularly, along stretches of minor rivers leading to the fly communities on the Volta itself seaward of the dam, are indicated as control measures which may be adequate.

Filariasis: This presents no obviously serious problems. Control of mosquitoes for malaria should be effective against transmission of *Wuchereria bancrofti* by the probable principal vectors, *A. gambiae* and *A. funestus*. There is little evidence of loiasis, or of the presence of *Chrysops* in the Gold Coast. *Dipetalonema perstans*, transmitted by *Culicoides*, is known to occur in the Gold Coast. For filarial diseases generally, apart from onchocerciasis which is well documented, there is a general recommendation for immediate simple surveys to determine incidence and significance more thoroughly than is known at present.

Yellow Fever: Occasional cases have been known since the last epidemic in the coastal area in 1937. No method exists of controlling mosquitoes which breed in forests and may maintain the reservoir of yellow fever in monkeys. Emphasis should be given to a campaign against domestic

Aëdes aegypti in the region of the proposed development schemes and to sustained control after the schemes are concluded. Immunization of at least immigrant labour, preferably the entire population, is advocated. Control of *Aëdes aegypti* would be appropriate in prevention of dengue, of which small outbreaks have occurred in the Gold Coast.

Schistosomiasis: Both *S. haematobium* and *S. mansoni* occur in the Gold Coast; the former is more prevalent on the Lower Volta. Snails of the genera *Physopsis* and *Bulinus* are intermediate hosts. Impoundment is thought likely to increase the breeding areas of the snails along the reservoir banks but a considerably greater anxiety is the breeding potentialities offered by the ramifications of the irrigation system for the coastal plains. Control would seem to depend on proper sanitary customs and facilities, molluscicides, and education of the African. The reader is referred to a separate report to be prepared by Dr. Elmer Berry.

Guinea-worm is prevalent in rural districts of the Gold Coast. It may well be a troublesome infection in the labour force, as well as the indigenous population. The usual practice of providing properly constructed wells, preferably with pumps, is recommended.

The photographs illustrate some of the features of the rivers and landscape of the Volta River basin. *D. S. Bertram*

Colonial Insecticide Research. **Progress Report No. 15, November 1953 to June 1954.** 19 mimeographed pp. 1954. Arusha: P.O. Box 204, Tanganyika.

This report gives current details about a number of investigations in progress at the Colonial Office Research Station at Arusha.

After a few data on tsetse-fly trials, there is some interesting information on anti-mosquito work at Taveta, in which experimental huts were used [see Davidson, this *Bulletin*, 1953, v. 50, 1011]. The continuation of these trials has shown the long residual effect of high doses of *gamma* BHC applied to mud walls. For example, 177 mgm./sq. ft. in a wettable powder was still killing 70 per cent. of anophelines after 10 months and about 50 per cent. up to 14 months. In a urea-formaldehyde resin, 210 mgm./sq. ft. of *gamma* BHC was killing over 90 per cent. after one year.

Additional experiments with dieldrin have shown that 40 mgm./sq. ft. begins to fail at 5 months on mud plaster, though 77 mgm./sq. ft. was effective after a year on sand and mud walls. These results query the accuracy of the earlier report of long effectiveness of low doses of dieldrin [Davidson, *loc. cit.*] which were made before adequate chemical estimations were available as at present. A second dose of dieldrin at 33 mgm./sq. ft. on a previously failing hut treated with 38 mgm./sq. ft. was more effective than the first treatment had been, suggesting that the mud wall was partly impregnated by the first application.

Laboratory tests show that air-borne particles of dieldrin from treated walls are much more lethal to mosquitoes than those from DDT treatments (experiments 4 and 5 months after application).

Some experiments with defoliants sprayed from aircraft (for possible application in tsetse control) are reported in some detail. The chemical used was trichlorophenoxyacetic acid ("2,4,5-T") sprayed at various rates from about $\frac{1}{4}$ to 2 lb. per acre. It was found that approximately 70 per cent. of the larger trees and a similar proportion of the undergrowth was rapidly defoliated by the spray. With a single application, this effect lasted at least 4 months but there was considerable regeneration after 6 months. A second spraying delayed regeneration beyond this period.

Some laboratory tests of various types of spraying equipment are reported. The general conclusion was that the flat-fan type of nozzle gave a more even deposit than a hollow cone type, if handled intelligently. The deposits to be expected at various pressures and spraying distances are given for some of the nozzles tested. *J. R. Busvine*

Gevaudan, P. Campagne de démoustication dans une zone résidentielle limitée de la Camargue. (Résultats obtenus.) [**Mosquito Eradication Measures in a Small Residential Area in the Camargue**] *Rev. d'Hyg. et de Méd. Sociale.* Paris. 1954, v. 2, No. 5, 468–80, 1 map. [30 refs.]

The zone selected for this experiment was the Pechiney quarter of Salin-de-Giraud, situated in the south-east angle of the Rhône delta. This is a hamlet with 2,500 inhabitants. Conditions here are favourable to anophelines of the *maculipennis* group, to *Anopheles hyrcanus*, to *Culex pipiens* and *C. molestus* and to *Aëdes* (*ochlerotatus*) *dorsalis*, *detritus* and others, thus many different situations exist which require control. The types of apparatus and insecticides used are described here, together with the cost of controlling the area. On the basis of this experiment it has been possible to put into operation a scheme for the complete eradication of mosquitoes from Salin-de-Giraud. *Anne Hudson*

Foote, R. H. **Pictorial Keys to the Mosquitoes of Medical Importance. VII. Spain and Portugal.** *Mosquito News.* 1954, Sept., v. 14, No. 3, 150–52, 1 fig.

Cook, D. R. **VIII. West Indies.** *Ibid.*, 152–3, 1 fig.

Aitken, T. H. G. **The Culicidae of Sardinia and Corsica (Diptera).** *Bull. Entom. Res.* 1954, Sept., v. 45, Pt. 3, 437–94, 2 figs. [Numerous refs.]

This paper is based on collections by the author in Corsica in 1944 and in Sardinia from 1946–1952, during the eradication campaign under ERLAAS; 42 species of mosquito are recorded, besides a few species of the related non-biting Dixinae and Chaoborinae. Keys to differentiate the larvae, pupae, and adults of these subfamilies are given as well as keys to species in each subfamily; the keys are usually to larvae and adults, sometimes also to pupae. Notes are given under species on biological characteristics and, especially, features of taxonomic interest or difficulty. None of the species is new but faunal records for Sardinia are increased by 20 and for Corsica by 3 additions. The male of *Taeniorhynchus buxtoni* is described for the first time from Sardinian material. Genera are represented by the following numbers of species: *Dixa* (7), *Chaoborus* (3), *Anopheles* (12), *Uranotaenia* (1), *Culiseta* (6), *Orthopodomyia* (1), *Taeniorhynchus* (2), *Aëdes* (12), and *Culex* (8). *D. S. Bertram*

Lee, D. J., Clinton, K. J. & O'Gower, A. K. **The Blood Sources of some Australian Mosquitoes.** *Australian J. Biol. Sci.* 1954, Aug., v. 7, No. 3, 282–301. [15 refs.]

The present work has been stimulated by the need for more information as to which species of Australian mosquitoes feed upon rabbits, and might be concerned in the transmission of myxomatosis; also in relation to the transmission of Murray Valley encephalitis.

No difficulty was found in collecting blood-fed mosquitoes in houses, stables, poultry runs and so forth. Others were caught on the banks of rivers and creeks [and one would welcome more information as to the exact spots in which gorged mosquitoes have been found, a matter which causes difficulty in many parts of the world]. It is also reported that mosquitoes containing blood are sometimes attracted to man in the field.

The paper is substantial, based on the results of 1,400 precipitin tests. The authors prepared their own antisera from man, several domestic animals, a marsupial (*Trichosurus*), domestic poultry and several lizards. All the antisera were prepared in rabbits with the exception of the anti-rabbit serum. In the majority of cases a titre of 1 in 8000 or higher was obtained.

The results are set out clearly in a series of tables and dealt with under the separate species of mosquito. The largest number of tests (778) was on *Anopheles annulipes*; setting aside just over 100 which were negative, 576 were positive for rabbit, 48 for fowl and smaller numbers for ox, horse, man and dog. When the results for this insect are set out according to the place of collection, one observes that of 79 specimens from a farmyard 15 were negative, 31 positive for fowl, 27 for ox: on the other hand, of 108 specimens from a river flat 34 were negative, 51 positive for rabbit, 15 for horse and so forth. The fact that this insect feeds mainly on mammals but to a considerable extent on domestic fowls is also interesting. The question is raised by the authors as to what can have been its main source of blood before Europeans introduced domestic animals. Large numbers of specimens of *Culex fatigans* were also examined showing a strong preference for fowl, man coming as the second host. On the other hand, *C. pipiens australicus* fed on fowl and rabbit almost equally.

Culex annulirostris was shown to feed mainly on rabbit, secondly on fowl and after that on a number of mammals. The marsupial was only an occasional host for a few sorts of mosquitoes: but 24 of the 32 *Aëdes queenslandis* had fed upon it. This mosquito has been observed biting caged rabbits in the field and is attracted to man as a bait.

It is remarkable in view of experience in other countries that no cases are recorded of an individual mosquito having fed on two or more species of host.

The authors discuss the relation of their work to the epidemiology of Murray Valley encephalitis: they want more information on mosquitoes which bite wild birds or birds and mammals.

[If English is almost an international language it should not be written nationally, or carelessly. The reviewer, a zoologist with an adequate command of English, recognizes " possums " and " phalangers," but does not know whether the words refer here to the same marsupial, and if so whether it is *Trichosurus*. He supposes that " anti-goanna serum " must be an immunological term.] *P. A. Buxton*

Keller, J. C. & Chapman, H. C. **The Toxicity of Phosphoric Acid Esters to Anopheline Larvae.** *J. Econom. Entom.* 1954, Aug., v. 47, No. 4, 628–30.

Of 274 phosphoric acid esters evaluated in the laboratory for their toxicity to fourth stage larvae of *Anopheles quadrimaculatus* in acetone-distilled-water suspensions at concentrations ranging from 0·1 to 0·0005 p.p.m. of the toxicants, only 14 showed sufficient toxicity to justify further testing in the field. As given in their order of toxicity in the laboratory, these components were:—Sulfotepp > Parathion > EPN > Methyl Parathion > *O*-(2-chloro-4-nitrophenyl) *O*,*O*-dimethyl thiophosphate > Malathion >

ethyl *o*-nitrophenyl thionobenzenephosphate > Diazinon > para-oxon > *O*-(3-chloro-4-methylumbelliferone) *O,O*-dimethyl thiophosphate > chlorthion > Potasan > *O,O*-diethyl *O*-piperonyl thiophosphate > NPD. DDT (as a check) was less toxic than the first three but at least equal to the others. When field tests were carried out with these compounds, there was a marked difference in the order of their effectiveness. EPN, *O*-(3-chloro-4-methylumbelliferone) *O,O*-dimethyl thiophosphate, parathion and DDT were about equally effective and occupied the top of the list, especially at low dosages. Methyl-parathion, diazinon, para-oxon and NPD were of intermediate toxicity, and Sulfotepp, malathion and potasan were of least promise. *G. R. Shidrawi*

Hosoi, T. **Egg Production in** *Culex pipiens pallens* **Coquillett. I. Seasonal Changes.** *Japanese J. Med. Sci. & Biol.* 1954, Feb., v. 7, No. 1, 57–73, 2 figs. [28 refs.] **II. Influence of Light and Temperature on Activity of Females.** *Ibid.*, 75–81.

Culex pipiens pallens overwinter as adults hibernating in empty sheds and buildings in the neighbourhood of human dwellings. In the vicinity of Tokyo females are first observed about the middle of March when the temperature rises to 15°C., larvae are found in April and males in May. House-frequenting and man-biting reach a maximum in June and July and cease again during the first 10 days of October when the average temperature is still fairly well above 15°C. Towards the end of October man-biting ceases altogether and large numbers of males and females can be observed in the region of suitable hibernation places.

Wild caught females collected at various times of the year were tested in the laboratory for biting activity and egg development. Considerable variation was shown by individuals of the same batch, but overall results showed that females caught during the spring and summer months were more active than those collected in the late autumn and winter and subsequently put into favourable conditions.

Wild caught larvae and pupae collected in the autumn and raised at atmospheric temperature developed into adults of reduced activity; their activity increased when the temperature was raised.

Further experiments were carried out to ascertain the way in which light and temperature can alter the biting activity and formation of eggs.

A comparison of the activity of females of 5 consecutive generations shows that the F_2 and F_3 generations raised in the spring had a much higher reproductive index than F_4 and F_5 raised in the autumn.

Conditioning with low temperature in the later developmental stages shows that adult inactivity becomes manifest when the low temperature is applied to both the 4th stage larvae and the pupa or early adult. Conditioning by putting pupae and early adults into continuous, complete darkness reduced the activity of females markedly. This did not occur if the preceding 4th stage larvae were put into darkness. After emergence females lost their activity when maintained in darkness. Continuous illumination proved favourable for maintaining the reproductive capacity at a high level in any season. *Anne Hudson*

Hosoi, T. **Egg Production in** *Culex pipiens pallens* **Coquillett. III. Growth and Degeneration of Ovarian Follicles.** *Japanese J. Med. Sci. & Biol.* 1954, Apr., v. 7, No. 2, 111–27, 1 fig. [18 refs.]

Female *Culex pipiens pallens* were classified according to their size, represented by wing length, and each class was subdivided into groups

according to the stage of development of the ovarian follicles (Stages I–V). The mean numbers of developed follicles per mosquito of each class and group were calculated and used as a standard in experiments with substituted foods. The mean number of follicles was found to increase with wing length and to decrease by stages up to stage III, when it remained fairly constant.

Experiments with females raised from the same batch of larvae and fed on human blood showed that the decrease in the number of follicles occurs in the early stages of development, mainly in Stage II.

Large variations in egg formation occurred when females were fed on different sources of blood. In *C. pipiens pallens* an average of 310 follicles matured after feeding on chicken compared with 112 after feeding on man. Retarded or decreased egg production was found to follow an incomplete blood meal. Five per cent. casein solution promoted early follicle growth, up to Stage II in some cases. Mosquitoes fed on hen's eggs could develop a considerable number of follicles up to the final stage. Emulsified ovaries and testes of chickens were found to contain growth factors and when given in addition to casein, it seemed that these could be utilized to mature large numbers of follicles. *Anne Hudson*

Hosoi, T. **Egg Production in *Culex pipiens pallens* Coquillett. IV. Influence of Breeding Conditions on Wing Length, Body Weight and Follicle Production.** *Japanese J. Med. Sci. & Biol.* 1954, Apr., v. 7, No. 2, 129–34.

In the previous paper by this author [see above] the relationship between the size of the mosquito, measured by wing length, and the number of follicles was used to group similar females together for experimental feeding. It was found, however, that large variations occurred in the number of follicles found in females of the same wing measurement. Further experiments were carried out showing that different culture media produced changes in body weight, wing length and number of follicles reasonably in proportion to each other. But breeding at low temperature produced disproportionately long wings and at high temperature disproportionately short wings. The body weight was less sensitive to temperature change, and the number of follicles per unit dry weight of the body decreased at low breeding temperatures. *Anne Hudson*

Burchfield, H. P., Redder, Anna M., Storrs, Eleanor E. & Hilchey, J. D. **Improved Methods for rearing Larvae of *Aedes aegypti* (L.) for Use in Insecticide Bioassay.** *Contr. Boyce Thompson Inst.* 1953, Oct.-Dec., v. 17, No. 5, 317–31, 3 figs.

After the introduction of the photomigration method for the evaluation of organic insecticides (*Contr. Boyce Thompson Inst.*, 1952, v. 17, 57) it was realized that unless better rearing conditions could be developed, fluctuations in the vitality of the larvae would tend to nullify the advantages gained by this method. Consequently, a number of factors which affect larval resistance were investigated; the criterion used was their response in the photomigration test at a standard concentration of insecticide, which was chosen to be in this study 0·1 p.p.m. of heptachlor in carbitol-water suspension. Factors of main importance like age, instar and environment were regulated and an improved method for rearing larvae with relatively constant resistance characteristics was developed.

In assessing the importance of the relationship of larval age and instar, it was found that newly-hatched larvae failed to respond properly to light and did not migrate satisfactorily during the first 4–6 hours. Furthermore, their resistance to heptachlor at 0·1 p.p.m. as measured by T50 [time required to immobilize 50 per cent.] was very high initially. However, resistance dropped rapidly during the first 12 hours, after which it increased gradually until the first moult. It dropped suddenly after this and each subsequent moult but increased progressively during each instar and exceeded the initital resistance after 76 hours, in the 4th instar. This sudden drop in resistance after each moult was thought to be caused possibly by higher penetrability of the new skin. The best time for testing was therefore thought to be shortly after moulting, when resistance is low and the larvae can be maintained in distilled water for a considerable time before getting into the succeeding moult. Under the rearing conditions used, the 2nd instar lasted about 8 hours and the 3rd 24 hours and was thus more stable. But as the T50 was much shorter in the 2nd instar, which accelerates testing and increases sensitivity—of particular importance for chemicals that act slowly and are difficult to detect at concentrations below 1 p.p.m.—its use was preferred. Besides, the use of 2nd instar larvae also reduces the time required for rearing and the risk of toxic effects due to bacterial spoilage of the nutrient. Even under the best environmental conditions, the yield of 2nd instar larvae in 22–24 hours (which proved to be most convenient rearing for obtaining large hatches of larvae suitable for a complete day's testing) was variable. This situation was improved by maintaining the newly-hatched larvae for 18·5 hours in distilled water before the introduction of the nutrient which resulted in more uniform moulting.

In the environmental factors, the greatest source of error in the T50 test was that some larval populations floated on the surface of the test medium and these responded irregularly to insecticides, causing frequent inversions in the T50 values. Keeping the larvae immersed in water during the entire screening and washing procedure helped somewhat in reducing the incidence of flotation. However, the addition of small quantities of " Pluronic F-68 " (a polyethylene-polypropylene glycol) to the rearing and test media as a surface-active agent, was found to eliminate floating and cause no adverse effects either on larval growth or on susceptibility to toxicants. In addition to rearing factors, the way in which eggs were treated prior to hatching was found to affect growth and viability.

Finally, in the newly modified method used, the caged adults were fed on 1 per cent. dextrose solution, offered blood-meals on guineapigs for one hour a day and supplied with moist filter paper for oviposition. The eggs were collected every 24 hours, washed and stored on moist filter paper in a closed container for 5 days, and then air-dried for further storage. Filter paper strips containing moist 5-day-old eggs were hatched in Pyrex tubes containing 10 ml. of dextrose-saline solution for 15–30 minutes and larvae intended for the tests were transferred in batches of 2,000 to 12-litre flasks containing 8 litres of 10 p.p.m. solution of " Pluronic F-68 ". The flasks were stoppered with cottonwool and immersed in a water bath maintained at 29·5°C. After 18·5 hours, 250 ml. of water containing 0·25 per cent. of a mixture of brewer's yeast, blood albumin and sucrose, in the ratio of 5:3:2, was added, and the larvae were incubated for 22 hours. If most of them were 2nd instar, they were filtered out of the nutrient without exposure to the air, washed in 10 p.p.m. F-68 Pluronic solution and kept in batches of 100 in water containing enough wash solution to give 1 p.p.m. of " Pluronic F-68 " when diluted to prepare the test suspension. Where

1st instar larvae were still present after 22 hours, the incubation period was extended an hour or two to permit further moulting and any others were rejected.

Other tests in which 2nd instar larvae were exposed to 0·5 p.p.m. of chlordane or 0·1 to 0·2 p.p.m. of heptachlor, at intervals after removal from the nutrient solution, showed that T50 increased linearly during the first 8 hours and that it was necessary to subtract 0·7 minute for each hour after removal to obtain a standard value from the observed one. When correction for time was made after removal from the nutrient, tests on the day-to-day and batch-to-batch reproducibility, carried out before and after the improvements, showed that the standard deviation in T50 was reduced from 4·21 to 1·58 minutes. This is in the same range of reproducibility obtainable on replicate tests made on the same batch and limits the advantages in further improvements in larval uniformity unless accompanied by corresponding improvements in the test method itself.

Further causes of variability, such as the type and degree of microbiological contamination of the rearing medium and stability of adult cultures, were discussed. It was evident that larval viability undergoes periodic changes and this might be related to conditions in the adult colonies. *G. R. Shidrawi*

Treherne, J. E. **The Exchange of Labelled Sodium in the Larva of *Aedes aegypti* L.** *J. Exper. Biol.* 1954, Sept., v. 31, No. 3, 386–401, 9 figs. [17 refs.]

The investigations recorded in this paper deal with the rate of exchange of sodium between the haemolymph of *Aëdes aegypti* and the external medium.

Normal larvae and larvae with the anal papillae destroyed and the mouth blocked, were placed in balanced salt solutions containing the radio-active isotope of sodium, ^{24}Na. It was found as a result of these experiments, that the labelled sodium ions entered the haemolymph through the anal papillae, although smaller amounts made their way inside through the mouth and the general body surface also. The time for half exchange of sodium between the haemolymph and the external medium was about 62 hours. The rate of uptake was independent of the external concentrations. However, it was definitely increased by a rise in temperature of the external medium. Larvae with sodium in the haemolymph were able to retain it when placed in distilled water, even in the face of an extreme concentration gradient.

Experiments with the uptake of potassium ions by the larvae suggested that a separate mechanism was responsible for the accumulation of these ions in the haemolymph. *M. G. R. Varma*

Haufe, W. O. **The Effects of Atmospheric Pressure on the Flight Responses of *Aëdes aegypti* (L.).** *Bull. Entom. Res.* 1954, Sept., v. 45, Pt. 3, 507–26, 8 figs. [19 refs.]

Experiments were made to determine whether variations in atmospheric pressure affected the flying activity of female *Aëdes aegypti*. The apparatus used is illustrated and consisted of two carboys serving as chambers in which the pressure was changed as required and in which the tendency of the mosquitoes to "take off" from the walls was measured by counting such events during or just after the experimentally induced changes in the

pressure. Temperature and humidity were maintained at about 80°F. and 80 per cent. relative humidity. It was important to allow several hours (3 to 6) of acclimatization of the mosquitoes to an initial atmospheric pressure before making observations on the influence of change of pressure.

In mosquitoes acclimatized to pressure, activity in flying was much the same at stable pressures of 550 mm. up to 800 mm. Hg. If acclimatized to more than 735 mm. Hg, moderate changes of pressure up or down increased flight activity but the increased activity was 1·5 to 2·4 times greater with the lowering pressure than with the rising pressure. On the other hand, change of pressure in either direction from a level below 735 mm. Hg resulted, as before, in increased flight activity but the greatest increase now occurred with the rise in pressure and was as much as ten-fold. It is concluded that 735 mm. Hg is a critical pressure level, at least within these experiments. This critical level may, however, be affected by the atmospheric pressure prevailing at the time of emergence of the individual mosquito. In general, responses of the mosquitoes to atmospheric pressure changes, as measured by increased flight activity, were consistent for pressures and pressure changes approximating those in nature, but otherwise, at pressures below, for example, 550 mm. Hg activity was random and results of repeat experiments inconsistent. *D. S. Bertram*

Keener, G. G., Jr. & Edmunds, L. R. **Field Observations on Larval Growth Rates of Irrigated-Pasture Mosquitoes in Western Nebraska (Diptera, Culicidae).** *Mosquito News.* 1954, Sept., v. 14, No. 3, 131–8, 4 figs.

"Data on mosquito larval development were obtained from 14 temporary pool sites in salt grass pastures in western Nebraska, 1952. The larval growth rates of mosquitoes in the pools studied varied with the temperature, growth periods becoming shorter as the average air temperature increased. The minimum time for *Aedes dorsalis* to complete the larval stage was 5 days, *A. vexans* 4½ days, and *A. nigromaculis* 4 days at average air temperatures between 72° and 77°F. In two pools, where the larval populations differed greatly, the development rates of the first three instars were about the same; however, in the pool where higher larval populations prevailed, a greater percentage of the larvae remained in the fourth instar for a longer period.

"*Culex tarsalis* reached the fourth instar in an average of 7 days after flooding, and the pupal stage in 10½ days at average air temperatures between 70° and 77°F. After the pools were flooded, *C. tarsalis* larvae usually appeared in 2 or 3 days and the population density gradually increased as a result of periodic oviposition."

Deoras, P. J. **Breeding the Indian House-Fly (*Musca domestica nebulo* Fabr.) for Experimental Studies.** *Parasitology.* 1954, Nov., v. 44, Nos. 3/4, 304–9, 5 figs.

Schoof, H. F. & Siverly, R. E. **Privies as a Source of Fly Production in an Urban Area.** *Amer. J. Trop. Med. & Hyg.* 1954, Sept., v. 3, No. 5, 930–35.

These observations were made at Phoenix, Arizona, on 270 privies, none of which could be classed as fly-proof. Contents of the pits varied from solid to liquid with added garbage in some cases. A few privies were

examined in a village 3 miles away from the town. The larvae taken in representative samples of the pit contents were identified and counted (sometimes after breeding out to adult). As many as 71·5 per cent. of the privies were breeding numerous species of fly. The overall percentage abundance of species in town privies were as follows:—*Musca domestica* 44·6, *Sarcophaga* 31·1, *Muscina* 16·1, *Hermetia* 10·9, *Ophyra* 7·8, *Phoenicia* (*Lucilia*) 1·6, *Calliphora* 0·5, and other flies 4·1. Breeding was much less in winter than at other seasons, and there were some differences in the abundance of different species from time to time. In the village, *Muscina* accounted for 59·0 per cent. of the larvae taken, *Hermetia* for 44·6 per cent. and only 3·6 per cent. were *M. domestica*. But these data do not include summer-time samples. Syrphids began to appear in larval form as the excrement liquefied. *Musca* larvae occurred below over-lying crusts of excrement or in folds of paper or tissue. Poor light did not deter *M. domestica* from breeding in the privies.

In connexion with the association of flies and the spread of poliomyelitis, it is pointed out that, contrary to indications from work elsewhere in America, *Musca domestica* and not the blowfly was associated with human excrement. This may be partly due to the moist conditions provided in the privies during the summer when much else is very dry. The authors conclude that the best of fly-proof privies soon become unsatisfactory with usage and privy systems should be abandoned in favour of more modern methods.

The reversal of relative densities of *Musca* and *Muscina* in the town of Phoenix and the village is discussed. Dieldrin had been applied to the town privies some considerable time before but, in view of the wide differences in the general environmental conditions of town and village, the authors are not yet prepared to ascribe the high *Musca* larva density in the town privies to an effect of the chemical although they admit that dieldrin-resistant *M. domestica* have been found in Phoenix.

D. S. Bertram

Busvine, J. R. **Houseflies Resistant to a Group of Chlorinated Hydrocarbon Insecticides.** *Nature*. 1954, Oct. 23, v. 174, 783–5, 2 figs.

Resistance in house-flies to the insecticides *gamma* BHC, chlordane, dieldrin, aldrin and toxaphene appears to be distinct from resistance to DDT. Moreover, induced resistance to one of this series results in increased resistance to the others. The nature of the factor common to these insecticides, and the defence mechanism they activate in flies, are considered in this paper.

The discussion is based on tests of the resistance of 4 strains of housefly exposed originally in the field to insecticides in Uruguay, Omdurman (Sudan), Sardinia, and England and a fifth laboratory strain believed to be normally susceptible to insecticides. The Omdurman strain was *Musca domestica vicina* and the others were *M. d. domestica*. They were tested for resistance to *alpha* and *beta* chlordane, isodrin, endrin, *gamma* BHC, aldrin, dieldrin, and DDT, by topical application. With the normal susceptible strain toxicity increased in the order DDT, *alpha* and *beta* chlordane, isodrin, endrin, *gamma* BHC, aldrin and dieldrin. Despite the varied histories of contact with insecticides (chiefly DDT and *gamma* BHC) all the field strains showed the same pattern of resistance to the insecticides although the level of resistance differed with each strain. All were resistant to DDT. With the other insecticides, the highest resistance was to *alpha* and *beta* chlordane followed

in order by aldrin, dieldrin, *gamma* BHC, isodrin and, lastly, endrin. It is of interest that although the BHC resistance of three of these strains was acquired in the field, their resistance to chlordane, dieldrin and aldrin was higher than to the *gamma* BHC in these tests.

By bioassay, it is shown that the different rate of detoxification of the insecticides is not likely to be the explanation of the different levels of toxicity to the flies. If, however, molecular models are studied it can be seen [as a photograph shows] that 5 chlorine atoms form a pentagon in the molecule of the chlordane group of insecticides tested and in only *gamma* BHC of the several isomers of this compound. This configuration, it is suggested, is the toxophore responsible for the insecticidal activity of this group of insecticides and their related toxicity to resistant strains of fly. Confirmation is derived from tests with a highly chlorinated hydrocarbon (octochloropropane) lacking this pentagonal configuration. This was not highly insecticidal and its toxicity was of the same level with normal, susceptible and resistant flies. Moreover, although the signs of intoxication in flies affected by DDT differ from those observed in flies affected by the chlordane–*gamma*-BHC group of insecticides, there is a close similarity in the signs of poisoning within this group. Results in mammalian toxicology were known to reveal comparable similarities in the signs of poisoning. *D. S. Bertram*

i. Wingo, C. W. **House Fly Control with Diazinon.** *J. Econom. Entom.* 1954, Aug., v. 47, No. 4, 632–5, 2 figs.

ii. Hoffman, R. A. & Cohen, N. W. **House Fly Control with Residual Sprays of Organic Phosphorus Insecticides.** *J. Econom. Entom.* 1954, Aug., v. 47, No. 4, 701–3.

i. This paper records an investigation of the possibility of controlling flies resistant to chlorinated insecticides by the compound Diazinon [see Gasser, this *Bulletin*, 1954, v. 51, 746]. In laboratory tests, Diazinon added to the larval medium at 5 p.p.m. completely suppressed development. Nearly full grown larvae put on medium containing 1,000 p.p.m. were prevented from pupating and emerging as adults. Fresh deposits of Diazinon at 45 mgm. per sq. ft. rapidly paralysed adult house-flies beyond recovery.

Field trials were conducted in fly-infested dairy barns which were sprayed with a 1 per cent. suspension of Diazinon prepared from a wettable powder. At this rate, good control was observed for about 35 days. Field and laboratory data indicate that direct sunlight and high temperature substantially curtail the residual power of this insecticide.

ii. This paper deals with several phosphorus insecticides, some of which have been shown to be improved by the addition of synergists [see Hoffman *et al.*, *ibid.*, 1954, v. 51, 1312]. The experiments were all field trials, in a considerable number of fly-infested barns. The insecticides were sprayed as suspensions or emulsions to give deposits of 25–200 mgm. per sq. ft., either alone or in combination with sugar (as a bait) or with a synergist.

Diazinon was generally the best compound tested. At 50 mgm./sq. ft. it gave high control for a few days only and was ineffective by 2 weeks. At 100 mgm./sq. ft. it was highly effective for a few days and gave fair control for about 3 weeks. With 200 mgm./sq. ft. piperonyl butoxide, Diazinon was somewhat improved, giving high mortality for a week and fair control for 3 weeks. The addition of up to 400 mgm./sq. ft. sulphoxide, however, did not improve this insecticide.

The compounds Bayer 21/199 (3-chloro-4-methylumbelliferone *O-O*-dimethyl thiophosphate), Chlorthion (*O-O*-dimethyl-O-(3-chloro-4-nitrophenyl)-thiophosphate) and Bayer L-13/59 (a dialkyl phosphonate) were also tested. They only gave good control for 1–2 days when tested at 100–200 mgm./sq. ft. and the addition of piperonyl butoxide did not greatly improve them.

The addition of sugar (200–400 mgm./sq. ft.) to the residual sprays appeared to prolong their effectiveness to a small degree but did not seem to attract sufficient flies to improve control noticeably. *J. R. Busvine*

Incho, H. H. & Ault, A. K. **The Toxicity to House Flies of Allethrin Analogs in combination with Piperonyl Butoxide Analogs.** *J. Econom. Entom.* 1954, Aug., v. 47, No. 4, 664–72, 4 figs. [10 refs.]

"The furfuryl, thenyl and benzyl analogs of allethrin were tested on house flies by the turntable method to determine their effectiveness in oil-base sprays when used alone or in combination with piperonyl butoxide and each of seven of its analogs. Allethrin alone and combinations of allethrin with butoxide or its respective analogs were included as the standards.

"The three allethrin analogs when tested alone were shown to be less effective than allethrin alone. However, in combination with piperonyl butoxide and six of its seven analogs the furfuryl and thenyl analogs were generally equal to or more effective than allethrin with these synergists. The benzyl analog showed lower activity than the other two analogs of allethrin when tested alone or in combination with the same synergists."

Grandori, R., Grandori, L. & Facetti, D. Effetti tossici selettivi della carbacolina su alcune specie di insetti. [**Selective Toxic Effects of Carbacholine on certain Species of Insects**] *Boll. Zool. agr. Bachic.* Turin. 1951, v. 17, No. 2, 123–8. [Summary taken from *Rev. Applied Entom.* Ser. B. 1954, Sept., v. 42, Pt. 9, 130–31.]

Carbacholine (aminoformyl-β-hydroxyethyltrimethylammonium chloride) is a white, crystalline, hygroscopic powder, soluble in water but not in ether or chloroform. It is stable in solution, melts at 202°C., and has a physiological action similar to that of acetylcholine. In the tests described, it was found to act as a selective insecticide after the manner of the urethane 19258 (5,5-dimethyldihydroresorcinol-dimethylcarbamate [Dimetan]). It produced toxic symptoms on injection into adults of *Musca domestica* L. at a concentration of 0·01 per cent., caused 50 per cent. mortality at 0·046 per cent. (corresponding to 1·1 mmg. chemical per fly) and complete mortality in a short time at 0·1 per cent., and resulted in instant death at 0·25 per cent. When the flies were confined on glass that had been sprayed with solutions of carbacholine, a deposit of 1·2 gm. per sq. metre gave 100 per cent. kill in two hours, or in four hours if the flies were removed to clean containers after the first hour. A deposit of 7·5 gm. gave 100 per cent. kill in two hours on the day of application and 32 days later, and one of 0·7 gm. gave 100 per cent. knockdown and kill in 7 and 24 hours on the day of application and 100 per cent. kill in 26 hours after 40 days. Flies of laboratory strains resistant to DDT and chlordane were as susceptible to carbacholine as normal flies. On the other hand, injection into adults of *Leptinotarsa* (*Doryphora*) *decemlineata* (Say) of solutions at rates of up to 1 mg. carbacholine per insect had no effect whatever, and

adults of *Epicometis (Tropinota) hirta* (Poda) and *Calandra granaria* (L.) were also resistant to high doses.

Browning, T. O. **Water Balance in the Tick** *Ornithodoros moubata* **Murray, with particular reference to the Influence of Carbon Dioxide on the Uptake and Loss of Water.** *J. Exper. Biol.* 1954, Sept., v. 31, No. 3, 331–40, 6 figs.

The present investigations were undertaken as an extension of the work of Lees (*Parasitology*, 1946, v. 37, 1; *J. Exp. Biol.*, 1947, v. 23, 379) on water balance in ticks and also to resolve some of the differences of opinion regarding the effect of CO_2 on *Ornithodorus moubata*.

Ticks are able to protect themselves against dehydration by the help of the waxy layer in their epicuticle and also by closure of the spiracles. There is evidence to support the view that the epidermal cells also play a part in this. The author found that unfed nymphs of *O. moubata* were able to absorb water from moist air and also control the loss of water from their bodies. However, the ticks lost this power in atmospheres containing 30–45 per cent. CO_2 or more than 90 per cent. N_2. This loss occurred also immediately after the ticks had fed or gradually after they had been starved for some months. The concentration of CO_2 required to cause opening of the spiracles was only about 5 per cent., and the author thinks that the inability of ticks to restrict water loss under anaesthesia induced by high concentrations of CO_2, is mainly due to the inactivation of the epidermal cells, possibly effected through the central nervous system.

M. G. R. Varma

Vogelsang, E. G. & Días, J. A. T. S. Contribución al estudio de la fauna ixodológica de Venezuela. [**Study of the Ticks of Venezuela**] *Rev. Méd. Vet. y Parasit.* Caracas. 1953, Jan.–Dec., v. 12, Nos. 1/4, 3–62, 10 figs. & 2 pls. [Numerous refs.] English summary (9 lines).

Vogelsang, E. G. & Días, J. A. T. S. Nueva contribución al estudio de la fauna ixodológica en Venezuela. [**New Observations on the Ticks of Venezuela**] *Rev. Méd. Vet. y Parasit.* Caracas. 1953, Jan.–Dec., v. 12, Nos. 1/4, 63–89, 6 figs. [20 refs.] English summary.

Radford, C. D. **The Larval Genera and Species of 'Harvest Mites'. (Acarina: Trombiculidae).** *Parasitology.* 1954, Nov., v. 44, Nos. 3/4, 247–76, 108 figs. [Numerous refs.]

Munson, S. C., Padilla, G. M. & Weissmann, M. L. **Insect Lipids and Insecticidal Action.** *J. Econom. Entom.* 1954, Aug., v. 47, No. 4, 578–87, 1 fig. [24 refs.]

Work on insect control would be simpler if we knew how insecticides act on insects. It has been suggested that in species with considerable fat reserves, quantities of insecticides may be harmlessly immobilized in these tissues. This theory might explain the fact that at times insecticides are less lethal at higher than at lower temperatures, for at higher temperatures fats can hold larger quantities of these toxic substances.

Previous work has shown that the lipoids in certain species of insects can be modified by rearing at different temperatures, those reared at high temperatures having fats with higher melting points and lower iodine numbers, while the reverse is observed in those reared at low temperatures. It is suggested that fats with higher melting points should be able to immobilize larger quantities of insecticide. Variations in the resistance of the American cockroach, *Periplaneta americana*, to chlordane, bromine DDT, flourine DDT and DDT, were observed after preconditioning to different temperatures, and similar results were obtained with the fruit fly *Drosophila melanogaster* and the grain beetle, *Oryzaephilus surinamensis*. For the most part the insects reared at the higher temperatures were the more resistant, but anomalous results occurred and the final solution is probably not as simple as the proposed theory suggests.

Kenneth Mellanby

REPORTS AND SURVEYS

Lipparoni, E. Rilievi sul nomadismo nelle sue correlazioni nosografiche ed epidemiologiche in Somalia. [**Notes on Nomadism in its Relation to Epidemic and Other Diseases in Somaliland**] *Arch. Ital. Sci. Med. Trop. e Parassit.* 1954, Mar., v. 35, No. 3, 134–54. English summary.

Within its area of 500,000 square km., the country has 1¼ million inhabitants of whom over 934,000 are nomads. Nomads make up 80 per cent. of the population along the Juba valleys, half the population in the central districts and 93 per cent. of those who live north of the Webi Jebel. Many nomads herd camels, cattle, sheep and goats and have no fixed abode; they often set up rough shelters of such materials as they can find where they happen to stop, they may carry some sort of tent or other such portable camp outfit or they may just sleep in the open. There are semi-nomadic households who do some cultivation as well as leading a pastoral life: they have more or less static huts in hamlets; seasonally, however, the herds have to be driven to more distant grassland, and women, young children and the aged remain in the hamlets.

The open-air life which the nomad leads is in itself healthy but he has little opportunity of acquiring a resistance against the various infections which are prevalent and often endemic in an African town or village. With no endemic malaria, the nomad is particularly subject to epidemic attacks of the disease when wet weather favours a rapid multiplication of *A. gambiae* or other vectors. Anopheline breeding was not reported in the wells which the nomads generally use and which are usually brackish. Lacking an acquired resistance, the nomad is very liable to contract malaria from cattle markets, and even dispensaries and hospitals.

Tropical ulcer is common and the nomad habits favour chronicity and such complications as phagedaena. Neither the " tropicaloid " ulcer (due to *Micrococcus mycetoides*) of Castellani nor veldt sore was seen. There was a substantial rise in the incidence of venereal disease during 1940–50 but the improved means of treatment which are now available are providing a much better control. Yaws is rare among the real nomads but the disease is very common among the semi-nomad people, who follow agricultural as well as pastoral habits and who live in overcrowded, insanitary conditions.

Hookworm disease is fairly common among those nomads and semi-nomads who live in the neighbourhood of rivers; other nomad tribes show only a moderate prevalence of helminthic disease, including schistosomiasis.

The author considers tuberculosis to be, on the whole, less prevalent among nomad people than it is in urban and rural settlements. Nevertheless, when the nomad contracts a tuberculous infection he is liable to severe attack owing to his lack of acquired resistance, frequent malnutrition and, often seasonal, food deficiencies. The individual members of nomad tribes are often of very spare build and their thinness is considered by the author to be a characteristic metabolic manifestation.

Pneumonia and broncho-pneumonia are frequent causes of death.

During a smallpox epidemic in 1933–35, the author carried out a vaccination campaign which covered 800 km. of routes and involved 30,000 inoculations within 2 months. He treated nomad patients in temporary "isolation parks" and there was a higher mortality among these than in the case of townsmen who were treated in the permanent isolation hospital. There have been no epidemics since.

Madura foot and other fungus diseases of the skin were found to be particularly common among these nomads.

The author believes that nomad herdsmen are in a good position to spread tick-borne relapsing fever by carrying the insect vector (*O. moubata*) on their persons and clothes from one locality to another when, say, attending cattle markets. *J. Cauchi*

BOOK REVIEWS

ADDENDUM

In the review of **Nutrition in India** by Patwardhan, V. N., this *Bulletin*, 1954, v. 51, p. 1018, in line 2 of the title the name and address of the publishers should read: "Bombay 4: Indian Journal of Medical Sciences, Back Bay View, Opp. Charni Road Gardens, New Queen's Road," and not "Bombay: Hind Kitabs Ltd.," etc., as given.

Tidy, Henry [K.B.E., M.A., M.D., F.R.C.P.] & Walker, R. Milnes [M.S., F.R.C.S.] [Editors.] **The Medical Annual.** A Year Book of Treatment and Practitioners' Index. pp. ix + 524, 67 pls. (6 coloured) & 32 figs. 1954. 72nd Year. Bristol, 8: John Wright & Sons, Ltd., 42/44 Triangle West. Toronto: The Macmillan Co. of Canada, Ltd. [32s. 6d.]

Throughout thirty years in the tropics the regular arrival of the *Medical Annual* was the outstanding postal event of the reviewer's year. Of recent years the bookseller's market has been flooded—mainly from transatlantic sources—with Digests, Reviews, Recent Advances and other titles aiming at keeping the busy doctor up to date in special branches of medicine, but this old friend maintains its position as a universal guide.

For the worker in the tropical field one likes to think that this *Bulletin* and its companion the *Bulletin of Hygiene* are indispensable but to get a balanced view of current practice in all branches of the medical field, regular perusal of the old-established but ever new *Medical Annual* is advisable.

An introduction by the Editors draws attention to outstanding problems

including air pollution, claims for damages for negligence, fibrocystic disease of the pancreas, tobacco-smoking and lung cancer, the post-cholecystectomy syndrome, adrenalectomy for cancer, cobalt in radiotherapy, etc. Thereafter are found reviews in alphabetical order from Abdominal Surgery in Children to World Health Organization, each the signed work of an expert and accompanied by a bibliography of recent literature.

Published early in 1954, the book contains references late in 1953—the tropical section in the hands of Sir Philip MANSON-BAHR being notably up to date in such subjects as histoplasmosis in Great Britain and sprue.

The plates and illustrations are instructive and well produced. The review section is followed by a practitioners' index of new pharmaceutical preparations and of medical and surgical appliances. A classified list of English and American books published during the preceding 12 months is of particular value to overseas readers. The index is comprehensive and well arranged. The long association of Professor Rendle Short and Sir Henry Tidy has been broken by the death of the former but the publishers have secured a sound new surgical Editor in Professor R. Milnes Walker and the seventy-second annual issue maintains the high standard reached by its predecessors.

For its old friends the *Medical Annual* needs no review, but to the steadily increasing number of doctors trained in the tropics for work in torrid lands one may with confidence recommend this distillate of a host of weekly, monthly and quarterly journals as an excellent means of keeping in touch with world-wide medicine. *George R. McRobert*

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